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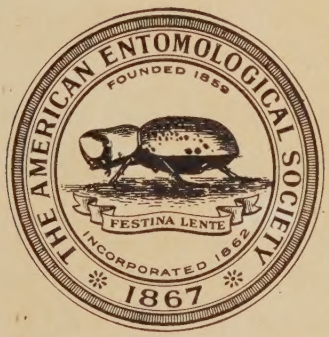

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LIST OF PAPERS

JONES (FRANK MORTON)
Our Largest Psychid, Oiketicus dendrokomos (Lepidoptera, Psychidae) 1
(Issued, April 14, 1926)

ALDRICH (J. M.)
Notes on Muscoid Flies with Retracted Hind Crossvein, with Key and Several New Genera and Species 7
(Issued, April 14, 1926)

BALDUF (W. V.)
On the Habits and Developments of a Checkered Beetle (Cymatodera undulata Say) 29
(Issued, April 14, 1926)

VAN DUZEE (M. C.)
A New Dolichopodid Genus with Descriptions of Five New Species (Diptera) 39
(Issued, April 14, 1926)

HEBARD (MORGAN)
A Key to the North American Genera of the Acridinae which Occur North of Mexico (Orthoptera, Acrididae) 47
(Issued, May 12, 1926)

WILLIAMS (ROSWELL C., JR.)
Studies in the Neotropical Hesperioidea (Lepidoptera) 61
(Issued, May 12, 1926)

DELONG (D. M.)
Three New Species of Cicadellidae Previously Confused with Related Species. The Genus Lonatura (Homoptera) 89
(Issued, June 1, 1926)

GODING (FREDERIC W.)
New Genera and Species of Membracidae (Homoptera) 103
(Issued, June 1, 1926)

MITCHELL (THEODORE B.)
New Species of Megachile, with Notes and Corrections (Hymenoptera, Megachilidae) 111
(Issued, June 20, 1926)

MOULTON (DUDLEY)
New American Thysanoptera 119
(Issued, June 22, 1926)

FRISON (THEODORE F.)
Descriptions and Records of North American Bremidae, together with Notes on the Synonymy of Certain Species (Hymenoptera) 129
(Issued, July 30, 1926)

HEBARD (MORGAN)
A Revision of the North American Genus Belocephalus (Orthoptera, Tettigoniidae) 147
(Issued, September 15, 1926)

ALLEN (H. W.)
Notes on Some North American Species of Achaetoneura with a Description of One New Species (Diptera, Tachinidae) 187
(Issued, September 15, 1926)

CRAMPTON, (G. C.)
A Comparison of the Neck and Prothoracic Sclerites throughout the Orders of Insects from the Standpoint of Phylogeny 199
(Issued, October 5, 1926)

CRESSON (E. T., JR.)
Descriptions of New Genera and Species of Diptera (Ephydridae and Micropezidae) 249
(Issued, December 16, 1926)

HEBARD (MORGAN)
Studies in the Dermaptera and Orthoptera of Colombia. Fourth Paper. Orthopterous Family Tettigoniidae) 275
(Issued, January 14, 1927)

HUGGINS (JOHN R.)
Variations in Size of Calopteryx Maculata and a Proposed New Subspecies (Odonata, Agrionidae) . . . 355
(Issued, January 19, 1927)

ERRATA

Page 106, insert DARNINAE as a subfamily just above Cyphotes insolitus new species.

INDEX

The names of new genera and of new species are followed by the name of the author (italics). Bold face numbers refer to the page on which that genus or species is particularly discussed. Numbers in italics refer to genera or species in synonymy. An asterisk (*) denotes a figure is referred to on that page.

PAGE

Abacata, Hammatofera 276
abbotii, Oiketicus 2
abbreviata, Micropeza *Cresson* **262**, 263
abdominalis, Plagiomima *Aldrich* 26, **27**
abducta, Megachile *Mitchell* **111**
Abia 228*
abnormis, Phlugis **349**
abnormis, Thysdrus 349
abortiva, Mesochloa 52
Acanthacara *148*
Acantherus 47, 48, 50, 55
(See also piperatus)
Acanthodis (see aquilina, curvidens, longicauda)
acawoios, Eudamus *Williams* ... **73***
aceri, Scirtothrips *Moulton* **122***
Achaetoneura 187
(see also achippivora, aletiae frenchii, hesperus, melalopha)
achippivora, Achaetoneura .. 187, **196**
Achurum 48
(see also sumichrasti)
Acrocara *50*
(see also maculipennis)
Acrididae 47
Acrolophitus 50
(see also hirtipes)
acuminata, Stomatomyia 14
acuticornis, Kophosoma *Van Duzee* 40, **44***
Adelphocoris (see rapidus)
admirabilis, Syrbula 51
adustus, Cocconotus 328
aerium, Callidium 29
Aeshna (see eremita)
Aethiomerus 148

PAGE

aethiops, Cocconotus 329
aethiops, Eucocconotus 330
affinis, Bremus **132**
affinis, Locusta 337
affinis, Neoconocephalus **337**
Ageneotettix 50
agesilaus, Eudamus *73*
Aglais (see antiopa)
Aglummyia *13*
(see also flavida, percinerea)
Agraecia (see pulchella, vittata)
Agraeciinae 346
Agrion 209*
(see also maculatum)
Aiolopus 48
Akentelus *51*
Alabama (see argillicea)
albertensis, Bremus **131**
albicuspis, Eudamus 65
albimargo, Eudamus **66***
albimargo, Goniurus 66
albimargo, Thymele 66
albistria, Eudamus **78***
albistria, Goniurus 78
albitarsis, Grallomyia 274
albofasciata, Chioides **77**
albofasciatus, Eudamus 77
albomarginatus, Chorthippus ... 56
alcaeus, Codatractus **76**
alcaeus, Eudamus 76
alciphron, Eudamus **85**
Alcmeone (see expansicornis, unstriga)
aletiae, Achaetoneura. 187, **188***, 196
alipes, Dysonia **278**
alipes, Phaneroptera 278
Allotrichoma (see atrilabris, lacteum, lasiocercum, litoralis, yosemite)
alternata, Plagiomima 25, **27**

alternata, Rainieria *Cresson*.... **268**
ambiguus, Bremus..... **135**
Amblytropidia..... 51
(see also ferruginosa)
americanorum, Bremus..... **136**
americanus, Atlanticus..... 356
americana, Plagia..... *14*
amica, Megachile..... 115
aminias, Codatractus..... **76**
aminias, Eudamus..... 76
amisus, Eudamus..... *62*
amoenus, Brachyauchenus..... 320
Amphitornus.....50, 51
Anaphotrips (see priesneri)
Anaulacomera (see apolinari, asema, biloba, biramosa, caucana, dentata, gibbera, gracilis, hirsuta, inermia, invisa, lanceolata, latifolia, nodulosa, phaula)
angustifrons, Conocephalus.... **348**
angustifrons, Xiphidium..... 348
Ankothrips..... **119**
(see also diffractus, fissidens, niezabitowski, robustus, yuccae)
annulata, Grallomyia..... 273
annulatus, Eucocconotus *Hebard* **330***
annulipes, Bliastes *Hebard*.....**316***
anomala, Plagiomima..... **26**
anomala, Siphoplagia..... 13
antennaepes, Calobata.....268, 26
antiopa, Aglais..... 188
Aphidina (see simplicipes)
Aphidinae..... 276
apolinari, Anaulacomera *Hebard* 302, **304***
apolinari, Cocconotus *Hebard*...**328***
appendiculata, Micropeza..... 262
appositus, Bremus..... **136**
arata, Phylloptera..... **307**
aratifrons, Cocconotus.....**327***
arcuata, Nephoplagia..... 12
argillicea, Alabama..... 188
argentatus, Bootettix..... 50
arida, Microchaetina..... 13
arizonica, Phoeniciomyia..... 13
Arixenia.....217*
arundineus, Thamnotettix *DeLong*..... **91***
aquilina, Acanthodis..... 312
asema, Anaulacomera *Hebard*..**295***
ashtoni, Psithyrus.....**136**, 144
asine, Eudamus..... **82***
asphaltina, Hyphinoe..... 107
Athalion (see latipes, picta)
Athyroglossa (see ordinata, tectora)
Atissa (see atlantica, durrenbergensis, hepaticoloris, kairensis, limosina)
Atissiella (see mabelae, setulosa)
atlantica, Atissa *Cresson*..... **253**
Atlanticus (see americanus, testaceus)
atrifrons, Bliastes..... **316**
atrifrons, Cocconotus..... 322
atrilabris, Allotrichoma *Cresson* **252**
atripes, Neria..... 271
Atropus.....220*
audax, Megachile..... **118**
auginulus, Eudamus..... *84*
auginus, Eudamus..... **84**
auginus, Goniurus..... 84
Aulocara..... 58
(see also elliotti, rufa)
aurantifolia, Cycloptera..... 333
auriceps, Plagiomima *Aldrich*..26, **28**
auricomus, Bremus..... **130**
aurifrons, Plagia..... *14*
Autographa (see oo)

Balli, Lonatura *DeLong*.....96, **97***
Banza..... 148
baracoa, Systellapha *Cresson*... **265**
Basileus (see diadematus)
Belocephalus..... **148**
(see also davisi, hebardi, hesperus, micanopy, peninsularis, proximus, rheni, sabalis, simplex, sleighti, subapterus, uncinatus)
belzebul, Calobata..... 270
biannulata, Micropeza *Cresson*.. **261**
bicolor, Kophosoma *Van Duzee* 39, **41***

bicolor, Lonatura....93, **96***
bicordata, Locusta.... 311
bicordata, Pycnopalpa.... **311**
bidentata, Gymnopa *Cresson*... **249**
bifarius, Bremus.... **134**
bilineata, Micropeza.... 261
biloba, Anaulacomera.... **293**
bilobata, Steirodontopsis.... 288
bimaculatus, Bremus.... **133**
binodosa, Parantonae *Goding*... **108**
binotata, Hydrina *Cresson*.... **256**
binotatus, Telostylus.... 258
bipartitus, Phlepsius *DeLong*... **90***
biramosa, Anaulacomera.... 302
bisulca, Moncheca....343, 345
bivittatus, Telostylinus *Cresson*. **259**
Blepharigena....10, **11**
Bliastes....314, 317, 319, 329
(see also annulipes, atrifrons, lineolatus)
Bombus (see californicus, columbicus, flavifrons, frigidus, insularis, kirbyellus, lacustris, lapponicus, mormonorum, nearcticus, nivalis, vagans, vinatus, vosnesenskii)
Bonnettia (see comta)
bonniwelli, Oiketicus.... 5
Boopedon.... 58
(see also nubilum)
Bootettix.... 50
(see also argentatus)
borealis, Bremus.... **135**
boyacae, Viadana *Hebard*....**305***
brachius, Eudamus.... *64*
brachius, Goniurus.... *64*
Brachyauchenus.... **319**
(see also amoenus, castaneus, difficilis, magdalenae)
Brachycoma (see macropogon)
brachyptera, Pseudopomala... 49
brachypterus, Conocephalus.... 338
brachypterus, Eritettix.... 52
brachypterus, Neoconocephalus **338***
Bremidae.... 129
Bremus (see affinis, albertensis, ambiguus, americanorum, appositus, auricomus, bifarius, bimaculatus, borealis, californicus, clarus, couperi, dimidiatus, dorsalis, edwardsii, expallidus, fervidus, flavifrons, franklini, fraternus, frigidus, huntii, impatiens, iridis, kenoyeri, kirbyellus, melanopygus, momonorum, morrisoni, nearcticus, nevadensis, pleuralis, polaris, proximus, prunellae, rufocinctus, rufosuffusus, separatus, severini, sladeni, sylvicola, ternarius, terricola, vagans, washingtonensis)
brevicornis, Truxalis.... 49
brevipennis, Copiphora.... 341
brevipennis, Tryxalis.... *49*
brevis, Kophosoma *Van Duzee* 40, **45***
brimleyi, Megachile *Mitchell*... **114**
Brisilis (see curvidens, longicauda)
Bruneria.... 56
(see also shastana)
brunneus, Stenobothrus.... 56

Calafia, Eudamus *Williams*.... **63***
calceata, Calobata.... 268
calceata, Notiphila.... 250
calenus, Eudamus.... *85*
californicus, Bombus.... 143
californicus, Bremus.... **143**
Callidium (see aerium)
Calobata (see antennaepes, belzebul, calceata, flavicoxa, geometra, nebulosa, placida, russula, simplex, varipes)
Calopteryx (see floridana, maculata)
camagura, Eudamus *Williams*... **81***
campanula, Synergus.... 33
Campodea.... 202
Canace (see nasica, nudata, snodgrassi)
canifrons, Ditrichophora *Cresson* **250**
cantata, Systellapha *Cresson*... **266**
capitata, Cockerelliana.... 11

capito, Copiphora 341
Capnia **210***
carinata, Tropidaspis 104
carinatus, Mesops 49
carinatum, Radinotatum 49
cariosa, Goniurus *63*
carmelitae, Cocconotus *Hebard* . **325***
carolinensis, Neria 271
carolinus, Phlepsius 90
carrikeri, Gryllacris *Hebard* **349***
cartaboensis, Scipopus *Cresson* .. **270**
castaneus, Brachyauchenus 320
castoreus, Deltocephalus 95
catalina, Lonatura 93, **99***
catillus, Chioides **77***
catillus, Eudamus 77
catillus, Papilio 77
caucana, Anaulacomrea *Hebard* . **302***
Caulopsis (see cuspidata, microprora, prora, sponsa)
caunus, Eudamus *82*
ceculus, Eudamus **84***
centricornis, Copiphora *Hebard* .. **340***
Centruchoides (see felinus)
Ceraia (see hemidactyla, rufovariegata, tibialis, zebrata)
Ceratomegilla (see fuscilabris)
Chaetonerius (see comperei)
Chaetoplagia (see modesta)
championi, Peucestes 286, 291
chalco, Eudamus **73***
chalco, Goniurus 73
chalco, Thymele 73
chales, Eudamus **66***
Chaulignathus (see pennsylvanicus)
Chetogena (see filipalpis)
Chibchella *Hebard* **317**
(see also personatus)
Chioides (see albofasciatus, catillus, macromaculatus, zilpa)
Chloealtis 53, 54
(see also conspersa)
Chlorophylla *333*
(see also vagifolia)
cholus, Eudamus *78*
cholus, Goniurus *78*
Chorthippus 55, 56, 59
(see also albomarginatus)
Chrysotus, sp 39
Cicada (see jubata).
Cicadellidae 89, 93
Cimbex 228
cinerea, Microchaetina 13
cinereus, Conocephalus **348**
cinereus, Horesidotes 55
circularis, Ochthera *Cresson* **254**
citrifolius, Posidippus 287
claripennis, Phorocera 7
clarus, Bremus *Frison* **139**
clavatus, Gomphocerus 55
Cleridae 29
Clinocephalus 54
(see also elegans)
Cnemidophyllum 287, 291
(see also lineatum)
cocanus, Conocephalus 340
cocanus, Homorocoryphus **340**
Cocconoti 314
Cocconotus 314, 317
(see also adustus, aethiops, apolinari, aratifrons, atrifrons, carmelitae, degeeri, ignobilis, pollonerae, vittagenae)
Cockerelliana **11**
(see also capitata)
Codatractus (see alcaeus, aminias)
Coelophyllum *308*
cognata, Plagiomima *Aldrich* .. 26, **27**
colombiae, Copiphora *Hebard* .. **341***
columbiae, Pristes *313*
columbiana, Systellapha 268
columbicus, Bombus **143**
comperei, Chaetonerius *Cresson* . **259**
comta, Bonnettia 7
concinnula, Orphulella 54
Conocephalus (see angustifrons, brachypterus, cinereus, cocanus, crassus, guttatus, heteropus, saltator)
consobrina, Euthyrrhachis **284**
consobrina, Plagiopleura 284
conspersa, Chloeatis 53

Copiphora 344
(see also brevipennis, capito, centricornis, colombiae, cornuta)
Copiphorinae 333
coquilletti, Cyrtophloeba *Aldrich* **12**, 22
coquilletti, Liqurotettix 59
Cordillacris 53
(see also occipitalis)
corni, Liothrips *Moulton* **124***
cornuta, Copiphora 340
cornuta, Kophosoma *Van Duzee* 40, **42***
cornuta, Tropidaspis 105
corona, Hydrina *Cresson* **256**
coronatus, Peucestes 286, 290
corrugata, Stilpnochlora *Hebard* . **288***
Corydalis 236
corydon, Goniurus *63*
costaricensis, Itarissa 309
couperi, Bremus **134**
coxalis, Kophosoma 39
crassifolia, Locusta 291
crassifolia, Phylloptera 291
crassifolius, Eupeucestes 287, **291**, 292
crassus, Conocephalus 338
crassus, Neoconocephalus **338**
crawfordi, Psithyrus **137**, 145
crenulata, Itarissa **308**
crenulata, Prosagoga 308
cristatissimus, Peucestes 290
cristulata, Systellapha *Cresson* . . **265**
cruenta, Gryllacris 350
cruenta, Vellea 281
Cryogonus **264**
(see also reedi)
Ctenothripella (see gillettei)
curvidens, Acanthodis **312**
curvidens, Brisilis 312
cuspidata, Caulopsis 333
cyanipes, Scyllina 57
Cycloptera (see aurantifolia, fagifolia)
Cymatodera (see undulata)
Cyphotes (see insolitus, nodosa)
Cyrtophloeba 11, **12**
(see also coquilletti)
Daeckei, Meganeria *Cresson* . . . **272**
davisi, Belocephalus 151, 163, 165, 167, **170***
decemnotatus, Telostylus 258
degeeri, Cocconotus 325, **327**
degeeri, Meroncidus 327
degeerii, Frontinus 288
delicatula, Stirapleura 57
Deltocephalus 94
(see also castoreus, lawsoni, megalopus, minuta, nebulosas, obtectus, pulicarius)
dendrokomos, Oiketicus *Jones* . . . **2***
dentata, Anaulacomera **300**
dentatus, Peucestes **290**, 292
Diabrotica (see 12-punctata, longicornis, vittata)
diadematus, Basileus *345*
diaphana, Quiva *Hebard* **276***
Dichromorpha 54
(see also viridis)
difficilis, Brachyauchenus *Hebard* **322***
diffractus, Ankothrips 119
dilator, Taeniaptera *Cresson* **274**
dimidiata, Phylloptera **306**
dimidiatus, Bremus **135**
dimidiatus, Gymnonerius *Cresson* **259**
dipteroides, Parantonae 109
Discocerina (see neiveifrons, simplex)
Discomyza (see u-signata)
Dishocaspis (see mamma)
dispar, Nerius *Cresson* **261**
disparata, Plagiomima 13, **26**
distenta, Micropeza *Cresson* **262**
Ditrichophora (see canifrons)
Dolichopodidae 39
domestica, Musca 36
domingo, Thymele *69*
dominicus, Eudamus *66*
dorantes, Papilio 62
dorantes Eudamus **62**
dorantes, Urbanus *86*, *87*
dorsalis, Bremus **136**
doryssus, Eudamus **64***
12-punctata, Diabrotica 35
durrenbergensis, Atissa 254

durus, Nerius *Cresson*..... **260**
Dysonia (see alipes, simplicipes)

Ecuadorensis, Systellapha..... 267
edwardsii, Bremus.....**133, 141**
Elaphidion sp..... 29
elegans, Clinocephalus..... 54
elegans, Exocephala..... *342*
elliotti, Aulocara..... 58
elongata, Rhodopteryx.....**333***
elongatus, Nannotettix..... **331**
Embia.....213*
Embidopsocus.....220*
Encoptolophus..... 48
Eosentomon.....203*
Epargyreus (see tityrus)
Ephydridae..... 249
Epiophlebia.....209*
eremita, Aeshna..... 356
Eritettix.....51, 52
(see also brachypterus, variabilis)
erucicola, Paraplagia.....12, 22
erythrocephala, Scipopus..... 270
erythrocera, Hesperomyia..... 12
esmerald. s, Eudamus **70***
Esselenia..... 52
(see also vanduzeei)
Euceraia *Hebard*..... **280**
(see also insignis)
Euclesia (see retracta)
Eucocconotus *Hebard*..... **329**
(see also aethiops, annulatus)
Eucyrtophloeba.....9, **12**
(see also horrida, rhois)
Eudamus (see acawoios, agesilans, albicuspis, albimargo, albistria, albofasciatus, alcaeus, alciphron, aminias, amisus, asine, auginulus, auginus, brachius, calafia, calenus, camagura, catillus, caunus, ceculus, chalco, chales, cholus, dominicus, dorantes, doryssus, esmeraldus, eurycles, evenus, flammula, galapagensis, ganna, glaphyrus, harpagus, hirtus, huancavillcas, interruptus, leucites, lindora, marmorosa, megaeles, metophis, minvanes, motilones, myrto, octomaculata, orion, parvus, proteus, protillus, rauterbergi, retractus, santiago, simplicius, stylites, tenuis, undulatus, velinus, virescens, zilpa)
Eupeucestes *Hebard*.....287, **290**
(see also crassifolius)
Eupnigodes..... 57
(see also megacephala)
Euptilopareia.....11, **12**
eurycles, Goniurus..... **87**
eurycles, Eudamus..... 87
Eusthenia.....212*
Eustollia *Goding*..... **105**
Euthyrrhachis..... 284
(see also consobrina, gracilis)
Euwalkeria *Goding*..... **104**
evenus, Eudamus..... **66***
evenus, Goniurus..... 66
exaltatus, Neoconocephalus.... 337
exigua, Scytodepsa..... 104
Exocephala (see elegans)
expallidus, Bremus..... 138
expansicornis, Alcmeone..... 108
extera, Lytogaster..... **257**

Fagifolia, Cycloptera..... **333**
falco, Sympycnus..... 39
falco, Kophosoma..... 40
fasciata, Musca..... 272
fasciata, Hoplocheiloma..... 272
felinus, Centruchoides..... 106
felinus, Orthobelus *Goding*..... **105**
femoratus, Nerius..... 260
fernaldae, Psithyrus.....**137**, 145
ferruginosa, Amblytropidia..... 51
ferruginosa, Williamsiana *Goding*.....**103***
fervidus, Bremus..... **136**
filipalpis, Chetogena..... 14
fissidens, Ankothrips..... 119

flammula, Eudamus..... *84*
flavida, Aglummyia..... 13
flavicaudata, Systellapha *Cresson* **266**
flavicoxa, Calobata..... 269
flavifrons, Bombus..... 143
flavifrons, Bremus..... **135**
flavifrons, Nerius..... 260
flaviventris, Morseiella..... 58
flavo-limbata, Itarissa..... 309
Flexocentrus *Goding*..... **106**
floridana, Calopteryx *Huggins*.. **364**
floridensis, Phorocera..... 194
Frontina (see frenchii, laeta)
Frontinus..... 288
(see also degeerii)
footei, Systellapha *Cresson*..... **266**
fortis, Urbanus..... *62*
foreli, Viadana..... **305**
franklini, Bremus..... **132**
frater, Kophosoma..... 39
fraternus, Bremus..... **130**
frenchii, Achaetoneura.....**196***
frenchii, Frontina..... 187
frigidus, Bombus..... 143
frigidus, Bremus.....135, **143**
frit, Scipopus *Cresson*..... **270**
frugiperda, Laphygma..... 190
fumipennis, Uclesia..... 14
furcatus, Hyleorus *Aldrich*..... **17**
furva, Lytogaster *Cresson*..... **257**
fuscibasis, Goniochaeta *Aldrich*.12, **24**
fuscilabris, Ceratomegilla..... 35
fuscus, Gymnonerius..... 259
fuscipes, Kophosoma *Van Duzee* 39, **40**

Galapagensis, Eudamus..... **64***
ganna, Eudamus..... **78***
ganna, Goniurus..... 78
ganna, Thymele..... 78
geometra, Calobata..... 272
geometra, Neria..... 271
geometroides, Meganeria *Cresson* **271**
gibbera, Anaulacomera *Hebard*..**296***
gigantea, Oiketicus..... 2
Gillettei, Ctenothripella *Moulton*.....**126***
gillettei, Thrips *Moulton*.....**126***
gilvimana, Rainieria *Cresson*... **269**
Ginglychaeta *Aldrich*.....10, **21**
(see also seriata)
glaberrimum, Orchelium..... 356
glaphyrus, Eudamus..... **80**
Gnathoclita (see sodalis)
Gomphocerus..... 55
(see also clavatus, rufus, sibericus)
Goniatron..... 59
(see also planum)
Goniochaeta.....10, **12**
(see also fuscibasis, plagioides)
Goniurus (see albimargo, albistria, auginus, brachius, cariosa, chalco, cholus, corydon, eurycles, evenus, ganna, herophilus, hirtus, ixion, kefersteinii, latipennis, larius, leucodesma, lindora, marmorosa, megacles, nicasius, nivosus, pilatus, procne, proteoides, retractus, simplicius, velinus, zagorus, zalanthus, zilpa)
gracilior, Itarissa *Hebard*.....**309***
gracilipes, Nannagroecia..... 347
gracilis, Anaulacomera..... **294**
gracilis, Euthyrrhachis..... 284
gracilis, Napaia..... 54
Grallomyia (see albitarsis, annulata, thienei)
grossa, Stethophyma..... 59
Gryllacrinae..... 349
Gryllacris (see carrikeri, cruenta, laevigata, salvini)
Grylloblatta.....213*
Gryllus (see triops)
guttulata, Philophyllia..... **312**
guttatus, Conocephalus..... *337*
Gymnonerius (see dimidiatus, fuscus)
Gymnopa (see bidentata, subsultans, tibialis)

Hammatofera (see abacata, nodicornis)

harpagus, Eudamus..... **74***
havanensis, Orthobelus..... 106
Helisula..... 58
Heliothis (see obsoleta)
hemidactyla, Ceraia..... **279**
hemidactyla, Scudderia..... 279
Hemimerus.....217*
hepaticoloris, Atissa..... 253
herophilus, Goniurus..... *68*
Hesperia (see metophis, octomaculata, orion)
Hesperioidea..... 61
Hesperomyia.....10, **12**
(see also erythrocera)
hesperus, Achaetoneura..... 187
hesperus, Belocephalus *Hebard* 151, **167***, 170
Heteropterina..... *14*
(see also nasoni, spinosula)
heteropus, Conocephalus..... *336*
heteroneura, Miltogramma..... 14
Hilarella.....9, **12**
(see also siphonina)
hilarella, Miltogramma..... 12
hilaris, Hypovoria..... 12
hirsuta, Anaulacomera *Hebard*..**301***
hirtipes, Acrolophitus..... 50
hirtius, Eudamus..... **83***
hirtius, Goniurus..... 83
Homorocoryphus..... 336
(see also cocanus, proximus)
Hoplocheiloma *Cresson*..... **272**
(see also fasciata, notitipennis)
Horesidotes..... 55
(see also cinereus)
horrida, Eucyrtophloeba..... 12
huancavillcas, Eudamus *Williams*..... **72***
huntii, Bremus..... **133**
hyalinus, Perilampus..... 194
Hydrina (see binotata, corona, nitida, pruinosa)
Hyleorus *Aldrich*.....6, **16**
(see also furcatus)
Hyperphrona (see nitidipennis)
Hyphinoe (see asphaltina, inermis)
Hypovoria.....10, **12**
(see also hilaris)

Ignobilis, Cocconotus..... *324*
impatiens, Bremus..... **133**
incisa, Stilpnochlora..... 288
inclusa, Melalopha..... 192
inermia, Anaulacomera..... 295
inermis, Hyphinoe *Goding*..... **107**
innotatus, Cocconotus..... **324**
innotatus, Meroncidus..... 324
insignis, Euceraia *Hebard*.....**281***
insolitus, Cyphotes *Goding*..... **106**
insularis, Bombus..... **141**
insularis, Psithyrus.....**137, 145**
integra, Megachile..... 115
integrella, Megachile *Mitchell*... **116**
integricauda, Parableta..... **285**
interruptus, Eudamus *Williams*. **65**
invisa, Anaulacomera *Hebard*...**297***
iridis, Bremus..... **131**
Itarissa..... **308**
(see also costaricensis, crenulata, flavo-limbata, gracilior, subcrenulata)
ixion, Goniurus..... ??

Japyx.....202*
jubata, Cicada..... 105
jubata, Tropidaspis *Goding*..... **104**

Kairensis, Atissa..... 254
kefersteinii, Goniurus..... *62*
kenoyeri, Bremus.....134, 138
kirbyellus, Bombus..... 142
kirbyellus, Bremus..... **142**
Klugia.....11, **12**
Kophosoma *Van Duzee*..... **39**
(see also acuticornis, bicolor, brevis, cornuta, coxalis, falco, frater, fuscipes, similis)

Laboriosus, Psithyrus..... 137
lacteum, Allotrichoma *Cresson*.. **252**
lacustris, Bombus..... **142**
laeta, Frontina..... 187
laevigata, Gryllacris..... 349

Lamiceps..... 344
lanceolata, Anaulacomera..... **301**
Laphygma (see frugiperda)
lapponicus, Bombus..... 141
larius, Goniurus..... *63*
lasciva, Musca..... 273
lasiocercum, Allotrichoma *Cresson*..... **251**
latifolia, Anaulacomera.....297, 299
latifrons, Sthenopleura *Aldrich*.. **18**
latipennis, Goniurus..... *87*
latipes, Aethalion..... 104
latitarsis, Psithyrus..... **144**
laurifolia, Stilpnochlora.....288, 291
lawsoni, Deltocephalus *DeLong*.. **89***
Lema (see trilineata)
Lepisma.....205*
leucodesma, Goniurus..... *78*
leucites, Eudamus..... **65**
Leuctra.....212*
limosina, Atissa..... 253
lindora, Eudamus..... *84*
lindora, Goniurus..... *84*
lineatum, Cnemidophyllum.... 287
lineolatus, Bliastes..... 315
lineolatus, Nastonotus..... **315**
lineolatus, Telostylinus..... 259
Linoceratium..... 54
Liothrips (see corni),
Liqurotettix.....50, 59
(see also coquilletti)
Listroscelinae..... 349
litoralis, Allotrichoma..... 253
littoralis, Plagiops..... 14
livida, Taeniaptera *Cresson*..... **274**
Locusta (see affinis, bicordata, crassifolia, maxillosa, repanda)
Lonatura..... **93**
(see also balli, bicolor, catalina, megalopa, melina, melleus, minuta, nebulosa, noctivaga, notata, salsura)
longicauda, Acanthodis..... **313**
longicauda, Brisilis..... 313
longicauda, Papilio..... *77*
longicornis, Diabrotica..... 35
longipes, Neria..... 271
losamatensis, Orphulella,..... 54
Lytogaster (see extera, furva, pallipes)

Mabelae, Atissiella *Cresson*..... **253**
Machilis.....205*
Macneillia.....51, 52, 53
(see also obscura)
macromaculatus, Chioides, *Williams*..... **77**
macropogon, Brachycoma..... 23
macropogon, ?Masistylum..... 23
macropogon, Menetus..... **23**
maculata, Calopteryx...**355**, 356, 364
maculatum, Agrion..... 357
maculipennis, Acrocara..... 50
magdalenae, Brachyauchenus *Hebard*.....**320***
magna, Scytodepsa *Goding*.....**104**
mamma, Dishocaspis.....29, 32, 37
marginata, Tachina..... 12
marginelle, Stilpnochlora..... 286
marmorosa, Eudamus..... **69***
marmorosa, Goniurus..... 69
Masistylum (see macropogon)
Mantispa.....227*
maxillosa, Locusta..... 336
maxillosus, Neoconocephalus... **336**
Mecostethus..... 59
media, Stomatomyia..... 14
megacephala, Eunogodes..... 57
Megachile (see abducta, amica, audax, brimleyi, integra, integrella, mucida, neglecta, oenotherae, rubi, semimucida, shermani, virginiana)
megacles, Eudamus..... **82**
megacles, Goniurus..... 82
megalopa, Lonatura..... 93
megalopus, Deltocephalus..... 95
Megalopyge (see opercularis)
Meganeria *Cresson*..... **271**
(see also daeckei, geometroides)
Melalopha (see inclusa)
melalopha, Achaetoneura *Allen* 187, **192**

melaneuris, Scipopus *Cresson*.. **271**
melanopleura, Orphulella..... 54
melanopygus, Bremus..... 142
Meleterus *Aldrich*.....10, **20**
(see also montanus)
melleus, Lonatura..... **97**
melina, Lonatura *DeLong*....96, **100***
Membracidae..... 103
Menetus *Aldrich*.....11, **23**
(see also macropogon)
mentalis, Tachinopsis..... *14*
meridionalis, Plagiops..... 14
Mermiria..... 49
(see also neomexicana)
Meroncidius (see degeeri, innotatus)
Mesochloa.....51, 52
(see also abortiva)
Mesops (see carinatus)
Metaplagia.....11, **12**
(see also occidentalis)
Metavoria.....11, **13**
(see also orientalis)
metophis, Eudamus..... **80***
metophis, Hesperia..... 80
micanopy, Belocephalus
151, 180, **183***
Microcentrum (see philammoa)
Microchaetina.....9, **13**
(see also arida, cinerea, valida)
Micropeza (see abbreviata, appendiculata, biannulata, bilineata, distenta, planula, recta, sagittifer, subrecta, tabernilla)
Micropezidae..... 258
Microplagia.....10, **13**
(see also nitens)
microprora, Caulopsis *Hebard*
333*, 334
Miltogramma (see heteroneura, hilarella)
Mimegralla (see niveimana, thaiensis)
minimipenne, Radinotatum.... 49
minor, Prostes..... **313**
minuta, Deltocephalus..... 93
minuta, Lonatura..... 93
minvanes, Eudamus *Williams*... **85***
Moncheca..... 343
(see also bisulca, pretiosa)
modesta, Chaetoplagia..... 13
montanus, Meleterus *Aldrich*... **20**
montezuma, Thymele..... *76*
Morseilla..... 58
(see also flaviventris)
mormonorum, Bombus..... 140
mormonorum, Bremus..... **140**
morrisoni, Bremus..... **130**
motilones, Eudamus *Williams*... **68***
Musca (see domestica, fasciata, lasciva)
mucida, Megachile..... **118**
myrto, Eudamus..... **69***

Nannagroecia (see gracilipes)
Nannotettix (see elongatus, spissus)
Napia..... 54
(see also gracilis)
nasica, Canace..... 257
nasoni, Heteropterina..... 14
Nasonimyia..... *14*
Nastonotus.....314, 329
(see also lineolatus)
nearcticus, Bombus..... 142
nearcticus, Bremus..... **134**
nebulosa, Calobata..... 265
nebulosa, Lonatura..... 93
nebulosus, Deltocephalus 93, 95, **101***
neglecta, Megachile..... **117**
neiveifrons, Discocerina *Cresson* **251**
Neoconocephalus (see affinis, brachypterus, crassus, exaltatus, maxillosus, nigropunctatus, productus, saturatus, triops, vicinus)
neomexicana, Mermiria..... 49
Nephoplagia..... *12*
(see also arcuata)
Neria (see atripes, carolinensis, geometra, longipes)
Nerius (see dispar, durus, femoratus, flavifrons)
nevadensis, Bremus..... **130**

nevadensis, Pedioscirtetes..... 50
nicasius, Goniurus..... **74**
niezabitowski, Ankothrips..... 119
nigricauda, Vestria.....345, **346**
nigricosta, Thrasymedes *Goding*. **109**
nigripalpis, Opsophagus *Aldrich*. **16**
nigromarginata, Plagiopleura... 284
nigropunctatus, Neoconocephalus..... 338
Nipponerius *Cresson*..... **260**
(see also femoratus)
nitens, Microplagia..... 13
nitida, Hydrina..... 256
nitidipennis, Hyperphrona..... **311**
nitidipennis, Plagioptera..... 311
nivalis, Bombus..... 142
niveimana, Mimegralla *Cresson*. **269**
niveus, Oecanthus..... 176
nivosus, Goniurus..... *64*
noctivaga, Lonatura.....93, 96, **101***
nodicornis, Hammatofera..... 276
nodosa, Cyphotes..... 106
nodulosa, Anaulacomera....295, 299
notata, Lonatura.....93, 96, **98***
Notiphila (see calceata)
notitipennis, Hoplocheiloma *Cresson*..... **272**
nubilum, Boopedon..... 58
nudata, Canace *Cresson*..... **257**

Oblata, Opsidiopsis..... 13
obscura, Macneillia..... 52
obscura, Opeia..... 50
obsoleta, Heliothis..... 188
obtectus, Deltocephalus.....95, 102
Ocana *Hebard*..... **343**
(see also robusta)
occidentalis, Metaplagia..... 12
occipitalis, Cordillacris..... 53
Ochthera (see circularis, pilosa, regalis, rotunda, triornata)
octomaculata, Eudamus..... **85***
octomaculata, Hesperia..... 85
Odontoscelia..... 260
Oecanthus (see niveus)
oenotherae, Megachile..... **118**
Oestroplagia..... *12*
(see also petiolata)
Oiketicus (see abbotii, bonniwelli, dendrokomos, gigantea, toumeyi, townsendi)
olivaceo-viridis, Syntechna..... **311**
oo, Autographa..... 188
Opeia..... 50
(see also obscura)
opercularis, Megalopyge..... 188
Opsidiopsis.....9, **13**
(see also oblata)
Opsophagus *Aldrich*.....9, **15**
(see also nigripalpis, ornatus)
Orcheilium (see glaberrimum)
ordinata, Athyroglossa..... 249
orientalis, Metavoria..... 13
orion, Eudamus..... **76***
orion, Hesperia.....*64*, 76
orion, Papilio.....*64*, 76
ornatus, Opsophagus *Aldrich*... **15**
Orophus (see tessellatus)
Orphulella..... 54
(see also concinnula, losamatensis, melanopleura, punctata)
Orthobelus (see felinus, havanensis)

Paedarium *Aldrich*.....11, **22**
(see also parvum)
pallescens, Thrasymedes..... 110
pallipes, Lytogaster..... 257
panamaensis, Systellapha *Cresson*..... **268**
Papilio (see catillus, dorantes, longicauda, orion, proteus, turnus)
Parableta (see integricauda)
Parantonae (see binodosa, dipteroides)
Paraplagia..... 11
(see also erucicola, rigidirostris)
parens, Taeniaptera *Cresson*.... **273**
Paropomala..... 47
parva, Vestria..... 345
parvipalpis, Plagiprospherysa.. 14
parvus, Eudamus..... **64***
parvum, Paedarium *Aldrich*.... **22**

Pedioscirtetes..... 50
(see also nevadensis)
Pelignus *Cresson*..... **254**
peninsularis, Belocephalus *Hebard*
150, 154, 155, 160, **162***, 165, 170
pennsylvanicus, Chaulignathus. 36
percinerea, Aglummyia..... 13
Perilampus (see hyalinus)
Periplaneta.....215*
personatus, Chibchella *Hebard*..**318***
petiolata, Oestroplagia..... 12
petiolata, Plagimasicera..... 13
Peucestes..... 286
(see also championi, coronatus, cristatissimus, dentatus, striolatus)
Peucestoides *Hebard*.....287, **291**
(see also stridulans)
Phaneroptera (see alipes)
phaula, Anaulacomera *Hebard*...**299***
philammoa, Microcentrum..... **311**
philippinensis,Telostylus *Cresson* **258**
Philophyllia (see guttulata)
Phlepsius (see bipartitus, carolinus)
Philibostroma.....50, 51
(see also quadrimaculatum)
Phlugis (see abnormis)
Phoeniciomyia.....10, **13**
(see also arizonica)
Phorocera (see claripennis, floridensis)
Phylloptera (see arata, crassifolia, dimidiata, tarasca, tessellatus)
picta, Aethalion *Goding*..... **105**
pilatus, Goniurus..... *86*
pilosa, Ochthera *Cresson*..... **255**
piperatus, Acantherus..... 55
pipiens, Taxigramma..... *14*
placida, Calobata.....265, 266
placidoides, Systellapha *Cresson* **265**
Plagia (see americana, aurifrons, rigidirostris)
Plagimasicera.....10, **13**
(see also petiolata)
plagioides, Goniochaeta.....12, 24
Plagiomima.....9, 13, **25**
(See also abdominalis, alternata, anomala, auriceps, cognata, disparata, similis)
Plagiopleura..... 284
(see also consobrina, nigromarginata)
Plagiprospherysa.....10, **14**
(see also parvipalpis, valida)
Plagioptera (see nitidipennis)
Plagiops..... *14*
(see also littoralis, meridionalis)
planula, Micropeza *Cresson*..... **264**
planum, Goniatron..... 59
Platybothrus..... *56*
pleuralis, Bremus.....**135**, 139
polaris, Bremus..... 143
pollonerae, Cocconotus..... **327**
Posidippus..... 287
(see also citrifolius, validus)
pretiosa, Moncheca.....**342***
priesneri, Anaphothrips *Moulton* **123***
Pristes (see columniae, minor, tuberosus)
procne, Goniurus..... *86*
productus, Neoconocephalus... **335**
prora, Caulopsis..... 333
Prosagoga..... *308*
(see also crenulata)
Prosopaea..... 187
proteoides, Goniurus..... *69*
proteus, Eudamus..... **69***
proteus, Papilio..... 69
protillus, Eudamus..... *62*
protillus, Thymele..... *62*
proximus, Belocephalus *Hebard*
150, 180, **181***
proximus, Bremus.....**132**, 140
proximus, Homorocoryphus.... 340
pruinosa, Hydrina *Cresson*..... **256**
prunellae, Bremus..... **131**
Pseudopomala.....47, 49, 53
(see also brachyptera)
Pseudophyllinae..... 312
Psilopa (see pulchripes, unica)
Psithyrus (see ashtoni, crawfordi, fernaldae, insularis,

laboriosus, latitarsis, suckleyi, variabilis, wheeleri)
Psoloessa 47, **57**
(see also texana)
pulchella, Agraecia *Hebard* **346***
pulchrifrons, Systellapha *Cresson* **267**
pulchripes, Psilopa 250
pulicarius, Deltocephalus 95
punctata, Orphulella 54
punctata, Tolania 105
punctata, Vestria 345
Pycnopalpa (see bicordata)
Pyrgocorypha (see uncinata)

Quadrata, Stilpnochlora **288**
quadratum, Steirodon 288
quadrimaculatum, Phlibostroma 51
Quiva *Hebard* **276**
(see also diaphana)

Radinotatum 48, **49**
(see also carinatum, minimipenne)
Rainieria 268
(see also alternata, gilvimana)
rapidus, Adelphocoris 36
rauterbergi, Eudamus **62***
recta, Micropeza *Cresson* **261**
reedi, Cryogonus *Cresson* **265**
regalis, Ochthera 255
repanda, Locusta 346
repanda, Vestria 345, **346**
retracta, Euclesia, *Aldrich* **24**
retracta, Uclesia *Aldrich* 14
retractus, Eudamus **64***
retractus, Goniurus 64
rheni, Belocephalus
150, 155, 156, **160***, 170
Rhodopteryx (see elongata)
rhois, Eucyrtophloeba 12
rhombifolia, Viadana 305
rigidirostris, Plagia 19
rigidirostris, Siphoplagia *18*
robusta, Ocana *Hebard* **344***
robustus, Ankothrips 119, 121
rotunda, Ochthera 254
rubi, Megachile 115, **117**
rufa, Aulocara 58
rufilabris, Scipopus 270
rufus, Gomphocerus 55
rufocinctus, Bremus **131**, 138
rufosuffusus, Bremus **133**, 138
rufovariegata, Ceraia 281
ruralis, Tachina 14
ruricola, Tachina 12
russula, Calobata 265

Sabalis, Belocephalus
152, 153, **172***, 177, 178
sagittifer, Micropeza *Cresson* ... **263**
salsura, Lonatura 93, 96, **100***
saltator, Conocephalus **348**
saltator, Xiphidium 348
salvini, Gryllacris 349
santiago, Eudamus **63**
Sarcophagidae 9
saturatus, Neoconocephalus *338*
Scipopus (see cartaboensis, erythrocephala, frit, melaneuris, rufilabris)
Scirtothrips (see aceri)
Scolia 231*
Scudderia (see hemidactyla)
Scyllina 57
(see also cyanipes)
secata, Tanipoda 268
semimucida, Megachile 118
separatus, Bremus **130**, 140
septemfasciata, Stictolobus *Goding* **108**
seriata, Ginglychaeta *Aldrich* ... **21**
setosa, Xenoplagia 14
setulosa, Atissiella 254
severini, Bremus *Frison* **138**
shastana, Bruneria 56
shermani, Megachile 113
shermani, Thamnotettix 91
Sialis **233**
sibiricus, Gomphocerus 55
Scytodepsa (see exigua, magna)
similis, Kophosoma 40
similis, Plagiomima 26, **27**
similis, Siphoplagiopsis 13
simplex, Belocephalus *Hebard*
152, 173, 174, **178***

simplex, Calobata..... 265
simplex, Discocerina..... 251
simplicipes, Aphidina..... 278
simplicipes, Dysonia.....276, **278**
simplicius, Eudamus.....69, 86
simplicius, Goniurus..... **86**
siphonina, Hilarella..... *12*
Siphoplagia..... *13*
(see also anomala, rigidirostris)
Siphoplagiopsis..... *13*
(see also similis)
sladeni, Bremus *Frison*.....131, **138**
sleighti, Belocephalus
152, 165, 173, **177***, 184
Smiliinae..... 108
snodgrassi, Canace..... 257
sodalis, Gnathoclita..... **314**
spinosula, Heteropterina..... 11
spinuliger, Systellapha *Cresson*.. **267**
spissus, Nannotettix..... **332**
sponsa, Caulopsis..... 334
Steirodon..... 286
(see also quadratum, validum)
Steirodontia..... 285
Steirodontopsis..... 288
(see also bilobata)
Stethophyma.....48, 59
(see also grossa)
Stenobothrus (see brunneus)
Sthenopleura *Aldrich*.....9, **18**
(see also latifrons)
Stictolobus (see septemfasciata, subulata)
Stilpnochlora..... 286
see also corrugata, incisa, laurifolia, marginelle, quadrata)
Stirapleura.....47, **57**
(see also delicatula)
Stomatomyia.....10, **14**
(see also acuminata, media)
stridulans, Peucestoides *Hebard*
287, **291***
striolatus, Peucestes..... *290*
stylites, Eudamus..... **74***
subapterus, Belocephalus
147, 150, **154***, 162, 167, 170, 172
subcrenulata, Itarissa *Hebard*...**309***
subrecta, Micropeza *Cresson*.... **261**
subsultans, Gymnopa..... 249
subulata, Stictolobus..... 108
suckleyi, Psithyrus.....**137, 144**
sumichrasti, Achurum..... 48
sumichrasti, Thymele..... *74*
sylvicola, Bremus.....**134, 142**
Sympycnus (see falco)
Synergus (see campanula)
Syntechna (see olivaceo-viridis, tarsaca)
Syrbula..... 51
(see also admirabilis)
Systellapha (see baracoa, cantata, columbiana, cristulata, ecuadorensis, footei, flavicaudata, panamaensis, placidoides, pulchrifrons, spinuliger)

Tabernilla, Micropeza *Cresson* **263**, 264
Tachina (see marginata, ruralis, ruricola, trepida, verticalis)
Tachinidae.....9, 187
Tachinopsis..... *14*
(see also mentalis)
Taeniaptera (see dilator, livida, parens, volens, vulpes)
Tanipoda..... 268
(see also secata)
Tanypoda..... 268
tarasca, Phylloptera..... 312
tarchon, Telegonus..... *77*
tarsaca, Syntechna..... **312**
Taxigramma.....9, **14**
(see also pipiens)
tectora, Athyroglossa *Cresson*... **249**
Telegonus (see tarchon)
Telostylinus (see bivittatus, lineolatus)
Telostylus (see binotatus, decemnotatus, philippinensis)
tenuis, Eudamus *Williams*..... **65**
ternarius, Bremus..... **133**
terricola, Bremus.....**132**, 139

tessellatus, Orophus..... **293**
tessellatus, Phylloptera..... 293
testaceus, Atlanticus..... 355
Tettigonia (see triops)
Tettigoniidae..... 275
texana, Psoloessa..... 57
thaiensis, Mimegralla *Cresson*... **269**
Thamnotettix (see arundineus, shermani)
thienei, Grallomyia..... 273
Thrasymedes (see nigricosta, pallescens)
Thrips, (see gillettei)
Thymele (see albimargo, chalco, domingo, ganna, montezuma, protillus, sumichrasti, vitreus)
Thyridopteryx..... 6
Thysdrus (see abnormis)
tibialis, Ceraia..... **279***
tibialis, Gymnopa..... 249
tityrus, Epargyreus..... 190
Tolania (see punctata).
toumeyi, Oiketicus..... 2
townsendi, Oiketicus..... 5
Triencentris..... 320
trepida, Tachina..... 11
trilineata, Lema..... 35
triops, Gryllus..... 339
triops, Neoconocephalus....337, **339**
triops, Tettigonia..... 339
triornata, Ochthera *Cresson*.... **255**
Tropidaspis (see carinata, cornuta, jubata)
Truxalis..... 49
(see also brevicornis)
Tryalis (see brevipennis)
tuberosus, Pristes..... 313
turnus, Papilio..... 355

Uclesia.....10, **14**
(see also fumipennis, retracta)
uncinata, Pyrgocorypha..... 176
uncinatus, Belocephalus *Hebard* 150, 155, **165***
undulata, Cymatodera..... 29
undulatus, Eudamus..... **74***
unica, Psilopa *Cresson*..... **250**
unistriga, Alcmeone *Goding*..... **107**
Urbanus (see dorantes, fortis)
Uropetala.....209*
u-signata, Discomyza *Cresson*... **250**

Vagans, Bremus.....134, **143**
vagans, Bombus..... 143
vagifolia, Chlorophylla..... *333*
valida, Microchaetina..... 13
valida, Plagiprosperysa..... *14*
validus, Posidippus.....287, **293**
validum, Steirodon.....286, 291
vanduzeei, Esselenia..... 52
variabilis, Eritettix..... 52
variabilis, Psithyrus..... **137**
varipes, Calobata..... 271
velinus, Eudamus..... **63**
velinus, Goniurus..... 63
Vellea..... 281
(see also cruenta)
verticalis, Tachina..... *14*
Vestria..... **343**
(see also nigricauda, parva, punctata, repanda, viridis)
Viadana (see boyacae, foreli, rhombifolia, zetterstedti)
vicinus, Neoconocephalus..... *338*
vinatus, Bombus..... *144*
virescens, Eudamus..... **68***
virginiana, Megachile *Mitchell*.. **113**
viridis, Dichromorpha..... 54
viridis, Vestria..... 345
vitreus, Thymele..... *82*
vittagenae, Cocconotus..... 327
vittata, Agraecia..... 346
vittata, Diabrotica..... 34
volens, Taeniaptera *Cresson*.... **273**
Voria.....9, **14**
vosnesenskii, Bombus..... **143**
vulpes, Taeniaptera *Cresson*.... **273**

Washingtonensis, Bremus *Frison* **138**
wheeleri, Psithyrus..... **145**
Williamsiana *Goding*..... **103**
(see also ferruginosa)

Xenoplagia.....9, **14**
(see also setosa)

Xiphidium (see angustifrons, saltator)

Yosemite, Allotrichoma *Cresson*. **252**
yuccae, Ankothrips, *Moulton*. . . . **119***

Zagorus, Goniurus *87*
zalanthus, Goniurus *87*
zebrata, Ceraia 281
zetterstedti, Viadana 305
Zorotypus 213*
zilpa, Eudamus. 78
zilpa, Chioides **78**
zilpa, Goniurus 78

PLANTS

Aloysia wrightii 4
Ampelopsis quinquefolia 29
Aristida gracilis 99
Arundinaria tecta 91
Caenothus 119
Carduus sp. 131, 132
Celastrus scandens 29
Cerocarpus montanus 119
Chrysanthemum 188
Coccothrinax argentea 147, 183
Cornus pubescens 126
Dichromena floridensis 99
Distichilis spicata 99
Eupatorium purpureum 131, 132
Galacita volubilis 115
Helianthus 127
Hypericum sp. 117
Impatiens biflora 132
Lachnocanlon anceps 97
Lupinus 118
Melilotus officinalis 127
Oenothera 118
Platanus 4
Robina 4
Rhus glabra 21
Rhynchospora divergens 99
Rubus 117
Sabal palmetto 147
Serenoa serrulata 147
Sideranthus spinulosus 127
Sporobolus sp 99
Tamarix 4
Yucca whipplei 121

TRANSACTIONS

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OUR LARGEST PSYCHID, OIKETICUS DENDROKOMOS N. SP. (LEPIDOPTERA, PSYCHIDAE)

BY FRANK MORTON JONES

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Over a long period of years there has been a slow accumulation of evidence that several species of large Psychids, not yet included in the north-of-Mexico lists, inhabit our arid southwest from Texas to Arizona inclusive. Heylaerts records (1884) a larval case from Arizona "couvert de grands morceaux de tiges, fixés seulement à leur bout supérieur"; in the United States National Museum are several very large cases and inflated larvae labeled "El Paso," not identifiable with any of our recognized species; from various Arizona localities the Barnes collection contains the cases of at least two unidentified species, and two flown specimens of male moths which further knowledge may associate with these cases; in 1904, Dr. Henry Skinner, in the Huachuca Mountains of Arizona, collected some immense cases representing two species and containing living larvae, but these larvae did not survive the winter in Philadelphia, and Dr. Skinner refrained from naming the insects from the immature forms; until the spring of 1925 the writer had similar experiences in failing to secure the imago from any of these cases, which have turned up from time to time. The difficulty in securing imagines is undoubtedly due to the fact that these large Psychids have a very

long larval life, passing the winter in this stage, and that they do not thrive in captivity or under changed climatic and food-plant conditions; therefore the few weeks between pupation and emergence (usually in April or May) offer the only favorable opportunity for the collection of the insects and the breeding of the winged males.

In May, 1925, the writer was fortunate in finding one of these species, in abundance, at this exact stage of development, thus securing good series of the larvae and their cases, pupae, and the moths of both sexes. This insect, which in size rivals *Oiketicus gigantea* Zeller of South America, is the largest Psychid yet discovered in North America, and seems abundantly distinct from all previously described species; for it is proposed the name of

Oiketicus dendrokomos new species (Plate I)

Larval Cases.—Length, when closed and attached for pupation, 80 to 105 mm. (males), 95 to 130 mm. (females); the naked flexible mouth of the case forms a loose frill, enclosing the point of attachment and the twig from which it is suspended; below this the case is completely covered with long leaf-stems and twigs (rarely with considerable admixture of leaf material) attached at their upper ends and projecting shaggily, obscuring the shape of the case and adding greatly to its diameter; at the lower end, the case of the ♂, for one-fourth to one-third its entire length (and that of the ♀ for a lesser distance) is bare of sticks, and here the texture of the brownish-gray silk is usually not obscured by attached fragments.

Larva.—Just before pupation. Width of head, 4 mm. (males), 6 mm. (females); the larva of the female attains a diameter of 13 mm. and a length of 75 mm.; head and thoracic segments with dark brown markings on a light ground, in such varying proportions (as usual in the genus) that some examples are predominantly dark, others predominantly light, but in general exhibiting the characteristic pattern common to the group; usually separable from *abbotii* and *toumeyi* by the markings of the front, which in these two species include a median dot (double, sometimes fused, sometimes slightly separated) midway between the frontal punctures and the frontal apex, but which in the present species and in *townsendi* is replaced by oblique shades, one on each side of the front opposite the adfrontal punctures and following the adfrontal sutures internally. From *townsendi* it is not satisfactorily distinguished except by size, in which it materially exceeds all recognized related species.

Pupa.—♂. Length 28 mm.; reddish brown, the thorax including the legs and wings, and the abdominal segments dorsally, darker; the free abdominal segments, caudally for about one-third their width, are smoother, duller, finely punctate rather than striate, and of a less reddish tone than the remaining areas, which are more or less striately rugose, the dorsum of the thorax polished; abdominal segments two, three, four, and five bear the usual row of cephalad-directed spines, and each of segments five, six, seven, and eight, a progressively more prominent spined ridge with caudad-directed teeth.

♀. Length 45 mm.; greatest diameter 12 mm. at the 5th and 6th abdominal segments, thence tapering gradually to the thoracic segments and caudally rather abruptly from the seventh abdominal segment; color rich reddish brown, darkened to almost black on the head, the thorax, and on abdominal segments one, nine, ten, and the anterior half of second; dorsally, the abdominal segments are all darker, duller, and more striately rugose; segments two, three, four, five, and six, for about two-fifths their width caudally, are conspicuously smoother, finely punctate, and of a dull purplish brown contrasting with the bright reddish tone of the adjacent areas; dorsally, abdominal segments two, three, four, and five bear cephalad-directed spines arising from low ridges, and segments four, five, six, seven and eight each bears a spined ridge with caudad-directed teeth, both series lower and smaller than in the ♂; the spiracles are dark in color and are not raised above the adjacent surface. In both sexes, most of the characters given apply equally well to the pupae of related species, and the present species seems to differ from them chiefly in size, robustness, and depth of color, rather than in its detailed structural characters.

Adult.—♂. Head and antennae, the thorax, abdomen, and ground color of wings, pale dull yellowish brown; eyes black; antenna with thirty-eight to forty-two joints; thorax and legs densely hairy; fore tibia with a moderately strong strap-like spine (epiphysis), its length four-tenths that of the tibia. Primaries: vein one, from wing-base to junction of 1a and 1b, broadly marked with a contrasting dark brown shade; the base of the cell similarly marked, but here the loosely attached dark scales are often lost in emergence; this dark shade is continued along the cubitus to the end of the cell, and in much decreased intensity of color evenly fills the cell and the terminal area of the wing, the demarkation between the light ground and the darkened area extending from the origin of vein two (Cu2) to the anal angle; the discocellulars are included in a vitreous bar which has pointed projections distally along the veins, between which the bar is narrowly bordered with darker brown. The secondaries are evenly colored, somewhat more thinly scaled, and slightly paler than the ground of

the primaries. The wings are 12–8 veined; eight and nine of primaries are stemmed to the cell, the stem one-sixth to one-fourth the distance from cell to apex; seven arises from a point with the stem of eight and nine, or rarely is slightly separated; four and five are usually from a point, sometimes very shortly stemmed, or occasionally slightly separated at the cell. In the secondaries, seven is obliquely connected with eight in the basal quarter, and again at or beyond the end of the cell, thence seven continues to the margin usually from below this oblique, sometimes in a continuous line from the base, or rarely from the oblique above its divergence from basal seven; four and five are usually separate at origin, occasionally from a point, rarely stalked; the faintly indicated 1c (1st anal) is usually joined to 1b (2nd anal) by a cross bar, midway of the wing. The abdomen is shaggily hairy, slender, tapering, and long, in dried examples usually exceeding the secondaries by their own width. The genitalia are proportionately narrower, the saccus longer, and the valves weaker, than in *townsendi* and other related species. Average wing expanse, 45 mm.; maximum 48 mm.

♀. Of the usual grub-like form; length (alive) 47 mm.; in alcohol, 35 mm., with a diameter of 10 mm.; dull yellowish white, the head and dorsum of thorax scarcely darkened to pale amber, glistening; eyes small, well rounded, faceted but imperfectly pigmented; the minute fleshy legs show some segmentation and bear spine-like claws; the caudal ring of down is smoky brown, and pale loosely-attached fluffy scales occur sparingly throughout.

Type Locality.—Alpine, Brewster County, Texas (altitude 4485 ft.); holotype ♂ bred May 5, 1925; allotype ♀, May 13, 1925; paratype material, thirty-two adult males, 2 females, 3 inflated and 3 alcoholic larvae, 20 ♂ and 5 ♀ pupal skins, 80 larval bags. Two paratype males and three bags are in the Barnes collection; the types and the remaining paratype material are in the collection of the author.

This insect was found in mid-April, 1925, on shade and ornamental trees in the streets and gardens of Alpine; at that time, nearly all the cases were attached for pupation and many contained pupae; subsequent emergences of adults, April 30 to May 15; foodplants noted, locust (*Robinia*), buttonwood (*Platanus*), salt cedar (*Tamarix*); in Musquiz Canyon, 20 miles north of Alpine, similar cases were found on a shrub identified for me by Prof. R. A. Studhalter as *Aloysia wrightii* (*Verbenaceae*), but no moths were secured from these cases.

The characteristic larval case of this insect, shaggy with wood (hence *dendrokomos*), and its greater size and robustness in all stages, serve to separate it from its nearest ally, *townsendi*. In *townsendi* (and *bonniwelli*) the cell of the fore wings of the ♂ is filled in solidly with blackish brown, which also conspicuously borders the vitreous bar distally; in *dendrokomos* only the lower margin of the cell is darkened to this degree, and the shade bordering the vitreous bar is narrower, leaving the terminal area more nearly uniform. Venational differences are usually but not invariably present: of thirty-two *dendrokomos*, twenty-one show four and five of primaries, and twenty-five show four and five of secondaries, either separate or from a point at the cell; and twenty-eight show seven of secondaries continued distally below the oblique, or else continuous from the base; *townsendi* and *bonniwelli* reverse these conditions, to the extent that of forty-five specimens studied, forty-one show four and five of primaries, and in thirty-three these veins of secondaries, *stemmed* to the cell, and all forty-five show distal seven arising above the divergence of the oblique.

The writer has visited the type locality of *townsendi* (Las Cruces, New Mexico) and has bred considerable series of males agreeing with the types; he has also collected and bred material from El Paso, Texas (less than fifty miles distant, and the type locality of *bonniwelli*); larvae brought from El Paso in 1923 and kept through the winter in Delaware yielded *bonniwelli* in the spring of 1924; larvae collected and bred in El Paso, 1925, from indistinguishable larval cases, from the same plant species, and apparently *from the same localized infestations*, yielded *townsendi;* bred series of *townsendi* from both Las Cruces and El Paso, compared with the type series of *bonniwelli* in the Barnes collection, show close resemblances, the obvious differences consisting of the darker and more smoky ground color and a general blurring of the pattern of *bonniwelli;* no consistent structural differences were detected. On this evidence, the writer believes *bonniwelli* to be a variety of *townsendi*, probably resulting from environmental factors at the time of pupation.

The bibliography of *townsendi* offers several knotty problems in nomenclature; in our lists (Smith's, Dyar's, Barnes & McDunnough's) it stands erroneously as *Oiketicus townsendi* Ckll.; in

our literature the insect seems to have been first mentioned by Townsend[1] as a new *Thyridopteryx* (no specific name); similarly without name by Dyar[2]; next by Townsend[3] as "*Oiketicus townsendi* (Riley MSS.)"; this paper definitely associates the Riley MSS. name with the adults described by Townsend in his earlier Canadian Entomologist paper, as well as with the larvae about to be described; Riley never having published, the insect becomes *Oiketicus townsendi* Townsend; Dyar[4] figures a segment of the larva of "*Oiketicus townsendi* Riley MSS."; Cockerell[5] illustrates "*Oiketicus townsendi* Riley MSS."; the same author[6] describes "*Oiketicus townsendi* Riley MSS.," and this has been quoted erroneously as the type description; later references seem to present no complications.

From the text of Townsend's first paper, giving numbers and dates of emergence, and from the pin-labels of the series of four males in the U. S. National Museum, it is apparent that all of these specimens formed part of Townsend's original series; one of the four, the specimen labeled "Type"[7] was also one of Cockerell's types, for it was sent to the Museum by Cockerell, April 17, 1899 (information kindly furnished by Dr. Dyar), hence it is proper to designate this specimen as the lectotype of both authors (Townsend and Cockerell); from its label data, a specimen in the Barnes collection was also one of Townsend's original series, from its date of acquisition it was one of the Las Cruces series when Cockerell prepared his papers, thus becoming a paralectotype of both authors; and the remaining series in the U. S. National Museum, Townsend paralectotypes. Dr. Dyar's larval material was from the same series, is preserved in the U. S. National Museum, and there is no reasonable doubt of its identity. The writer is indebted to Messrs. Barnes and Benjamin for some of the above references, as well as for having generously extended the use of their collections and material.

[1] Can. Ent., xxiv, p. 199, 1892.
[2] Ent. News, iv, p. 321, 1893.
[3] Zoe, iv, p. 356, January, 1894.
[4] Ann. N. Y. Acad. Sci., viii, p. 198, p. 205, marginal date May 1894.
[5] N. M. Agr. Ex. Sta. Bull. 15, p. 64, Jan. 1895.
[6] Ann. & Mag. Nat. Hist., (6) xv, p. 208, Feb., 1895.
[7] U. S. N. M. Acc. No. 34904, Type 4283, No. 3, iss. May 24.

OIKETICUS DENDROKOMOS JONES
(Adult male, male and female bags. Natural size.)

NOTES ON MUSCOID FLIES WITH RETRACTED HIND CROSSVEIN, WITH KEY AND SEVERAL NEW GENERA AND SPECIES

BY J. M. ALDRICH

United States National Museum

Probably no dipterist of the present generation in North America will fail to recall the character used by Coquillett in his key to Tachnid genera,—"Last section of fifth vein more than half as long as the preceding section," by which he separates out, on page thirty-four of his Revision, the genera Heteropterina, Paraplagia, and Metaplagia. It is precisely this character which is here used to analyze a group of muscoid genera, in the expectation that a key to these forms will be useful to others in making identifications, as it has been to me.

The hind crossvein has in these cases been drawn back toward the wing-base from its normal position near the margin; its posterior end especially has been drawn in, so as to lengthen the last segment of the fifth vein. In many cases this is a very striking character, but in others the retraction is less, so that some species occur in which Coquillett's expression does not make a clear division. This is especially true in Tachinids with the first posterior cell ending in the tip of the wing (Actia, Siphona, and related forms), none of which except Chaetophlepsis have the crossvein much retracted. I therefore omit from my key all species with the first posterior cell ending in the wing tip. In the remaining series, with first posterior ending decidedly before the tip, there are few cases difficult to decide. Among the genera which I have included, Opsophagus is nearest the dividing line, the last section of the fifth vein being hardly more than half the preceding; while among forms which I have omitted, I have found an occasional specimen of *Phorocera claripennis* Macquart and *Bonnettia comta* Fallen, with a noticeable degree of retraction of the crossvein. These are well-known and easily recognizable species.

The key does not include any species without hypopleural bristles. I do not know any Calliphoridae with retracted hind crossvein, but there are three genera of Sarcophagidae, forming the first section of the key. The remainder form four rather distinct and not closely related groups. Microchaetina is the first, clearly Dexiid; Hesperomyia and Microplagia form the second, of undefined relationship; Stomatomyia, Plagiprosopherysa, Plagimasicera and Phoeniciomyia, form the third, evidently related to *Phorocera claripennis*. The remaining twenty-one genera form a fairly compact group, characterized by the presence on the scutellum of a pair of suberect, tall, straight, spine-like bristles, almost at the tip, standing between and only a little above the apicals. This character occurs in allied forms with the crossvein in the usual position, Germaria for instance; it is therefore not possible to use it to define a tribe having retracted crossvein.

In all this series there is an almost freakish tendency toward the development of characters usually regarded as generic, as a result of which most of the genera have only one known species each. It is this condition which makes a key desirable, as it can be based almost entirely on strong and unmistakable characters.

The aim has been to include all the genera of the world within the above limits, as far as represented in the extensive collections of the U. S. National Museum.[1] It is to be expected, however, that only an approximation to completeness can be attained outside of North America.

I call the pteropleural bristle "large" when it is larger than any of the sternopleurals. The postscutellum, now recognized as of great importance in separating the larger muscoid groups, is a transverse ridge or hump below the scutellum, occurring in all Tachinidae and Dexiidae, but not in Calliphoridae and Sarcophagidae. An inspection of specimens of these families will quickly show what is meant by the term.

[1] Paratypes of several of the new species have been deposited in the collection of The Academy of Natural Sciences of Philadelphia.—[Ed.]

Key to Muscoid Genera Having the Last Section of Fifth Vein More Than Half as Long as the Preceding.

1. Without postscutellum (Sarcophagidae).....2.
   With postscutellum (Tachinidae).....4.
2. Venation greatly crowded to the front of the wing, last section of fifth vein twice as long as preceding (North America and Europe).....*Taxigramma* Perris.
   Venation almost normal, last section of fifth vein shorter than preceding.....3.
3. First vein setulose (Texas and New Mexico).
   Opsidiopsis Townsend.
   First vein bare (North America and Europe).
   Hilarella Rondani.
4. Arista short-plumose; first posterior cell petiolate; vibrissae high up and approximated; parafacials hairy, bristly below (North America)....*Microchaetina* Van der Wulp.
   Arista bare or only microscopically pubescent (in *Microplagia* with a few perceptible minute hairs above close to base).....5.
5. First vein setulose.....6.
   First vein bare.....14.
6. Discals present.....7.
   Discals absent.....8.
7. Facial ridges bare, parafacials with striking row of bristles, last section of fifth vein hardly more than half the preceding (Peru).....*Opsophagus* new genus
   Facial ridges bristly, parafacials bare and very narrow; last section of fifth vein about equal to preceding (Australia).
   Hyleorus new genus.
8. Lowest frontal turned down, no bristles below it on parafacial.....9.
   Lowest frontal turned up, parafacial without bristles....10.
   Parafacial with evident bristles.....11.
9. Fifth vein setulose; parafacial entirely bare below lowest frontal (Peru).....*Xenoplagia* Townsend.
   Fifth vein bare; parafacial with some erect hairs around and below lowest frontal (North America and Europe).
   Voria Robineau-Desvoidy.
10. With a very large pteropleural (North America).
    Sthenopleura new genus.
    Without pteropleural (North America).
    Plagiomina Brauer and Bergenstamm.
11. Eyes hairy (North and South America).
    Eucyrtophloeba Townsend.
    Eyes bare.....12.

12. Last section of fifth vein at least three times as long as preceding, venation much crowded forward; pteropleural large (Western United States)....*Goniochaeta* Townsend.
Last section of fifth vein shorter than preceding.....13.

13. Antennae inserted low down and very small, their length less than one-third the eye height, parafacials hairy, bristly below (Peru).....*Microplagia* Townsend.
Antennae ordinary, about as long as eye height (New Mexico).....*Meleterus* new genus.

14. First posterior cell distinctly petiolate.....15.
First posterior cell open.....18.

15. With a large pteropleural.....16.
Without or with small pteropleural.....17.

16. Costal segment between tip of third vein and petiole equal to the distance from the petiole to extreme tip of wing; pteropleural barely larger than hind sternopleural (Southwest United States).
Hesperomyia Brauer and Bergenstamm.
Costal segment between third vein and petiole hardly one-third as long as distance from petiole to apex; pteropleural much larger than hind sternopleural (North Africa and Sardinia).....*Hypovoria* Villeneuve.

17. Eyes hairy; facial ridges bristly; parafacials bare (Peru).
Plagimasicera Townsend.
Eyes bare; facial ridges bare; parafacials with hairs; front prominent; costal spine large; cheek more than half the eye height. (Europe and West United States.)
Uclesia Girschner.

18. With a large pteropleural (Europe and North America).
Blepharigena Rondani.
Without or with small pteropleural.....19.

19. Epistoma strongly protuberant, head longer on lower edge than at insertion of antennae, a row of bristles extending down the parafacials from the orbitals (Colorado).
Ginglychaeta new genus.
Head shorter on lower edge than at antennae.....20.

20. Facial ridges bristly half way up or more.....21.
Facial ridges not bristly.....23.

21. Eyes hairy (Europe). *Stomatomyia* Brauer and Bergenstamm.
Eyes bare.....22.

22. Palpi normal, small discals present (Arizona).
Phoeniciomyia Townsend.
Palpi short, discals wanting (North America and Europe).
Plagiprospherysa Townsend.

23. A row of downwardly directed bristles on the parafacial..24.
Parafacial without bristles.....28.

24. The parafacial bristles rather few and small, high up and near the facial ridge; front very wide and prominent (New Mexico).....*Cockerelliana* Townsend.
The parafacial bristles forming a strong row down nearly to the lowest level of the eye.....25.

25. Eyes hairy (Europe, North and South America). *Cyrtophloeba* Rondani.
Eyes bare.....26.

26. Penultimate joint of arista more than twice as long as wide (United States).....*Euptilopareia* Townsend.
Penultimate joint of arista not elongate, less than twice as long as wide.....27.

27. Front very broad, head bulging behind, parafacial with hairs as well as bristles (Europe)..*Klugia* Robineau-Desvoidy.
Front ordinary, head flat behind, parafacials with bristles only (Jamaica).....*Paedarium* new genus.

28. Facial depression deep and narrow, its edges prominent (New Mexico).....*Metaplagia* Coquillett.
Facial depression broad and shallow, its edges more flattened. 29.

29. Parafacial rather narrow, with small hairs over a considerable part of the surface (United States)..*Metavoria* Townsend.
Parafacial wide, face but little receding, hairy and with some small bristles near lower part of facial ridge (California.) *Menetus* new genus.

References, with List of North American Species

Blepharigena Rondani, Dipt. Ital. Prod., I, 1856, p. 69. Type and sole original species, *Tachina trepida* Meigen, of Europe.

Paraplagia Brauer and Bergenstamm, Zweifl. Kais. Mus., v, 1891, p. 354; VI, 1893, p. 147. Type and sole original species, *Tachina trepida* Meigen. A rather common North American species is *Heteropterina spiñosula* Bigot (*Paraplagia* of Coquillett, 1897), occurring from Ohio to Oregon and Mexico.

Cockerelliana Townsend, Jour. N. Y. Ent. Soc., XXIII, 1915, p. 216. Type and sole original species, *capitata*, new species, from New Mexico.

Cyrtophloeba Rondani, Dipt. Ital. Prod., I, 1856, p. 68. Type and sole original species, *Tachina ruricola* Meigen. **Cyrtophloeba coquilletti,** new name for *horrida* Coquillett, preoccupied by Giglio-Tos, is a rather common North American species. It has discals and *ruricola* has not.

Nephoplagia Townsend, Insecutor Ins. Menst., VI, 1918, p. 171. Type and sole original species, *arcuata,* new species, from Peru.

Eucyrtophloeba Townsend, Proc. U. S. N. M., LI, 1916, p. 316. Type and sole original species, *rhois,* new species, equals *horrida* Giglio-Tos, from Chihuahua, Mexico. Occurs also in Peru.

Euptilopareia Townsend, Proc. U. S. N. M., LI, 1916, p. 319. Type and sole original species, *Paraplagia erucicola* Coquillett, from Missouri.

Goniochaeta Townsend, Trans. Amer. Ent. Soc., XVIII, 1891, p. 351. Type and sole original species, *plagioides,* new species, of New Mexico. *Goniochaeta fuscibasis* herein described has the antennae wholly blackened, while in *plagioides* they are pale red to the arista.

Hesperomyia Brauer and Bergenstamm, Zweifl. Kais. Mus., IV, 1889, p. 114; V, 1891, p. 359; VI, 1893, p. 162. Type and sole original species *erythrocera,* new species, from Texas.

Oestroplagia Townsend, Proc. U. S. N. M., LVI, 1919, p. 566. Type and sole original species, *petiolata,* new species, hardly separable from *erythrocera.* Arizona.

Hilarella Rondani, Dipt. Ital. Prod., I, p. 70, 1856. Type and sole original species, *Miltogramma hilarella* Zetterstedt, of Europe. *Hilarella siphonina* Zetterstedt is a synonym, in the opinion of Professor Bezzi (letter). Common in North America.

Hypovoria Villeneuve, Bull. Mus. Hist. Nat., 1912, p. 510. Type and sole original species, *hilaris,* new species, from Northern Africa. In National Museum collection from Sardinia.

Klugia Robineau-Desvoidy, Dipt. Env. Paris, 1863, I, p. 787. Type designated, *Tachina marginata* Meigen, of Europe.

Metaplagia Coquillett, Jour. N. Y. Ent. Soc., III, 1895, p. 102. Type and sole original species, *occidentalis,* new species, from United States.

Metavoria Townsend, Insecutor Ins. Menst., III, 1915, p. 101. Type and sole original species, *orientalis*, new species, from United States.

Microchaetina Van der Wulp, Biologia, Dipt., II, 1891, p. 240. Type and sole original species *cinerea*, new species, from Mexico. The hind crossvein is in the middle between the anterior one and the bend of the fourth vein and the parafacials have some small bristles irregularly placed on the lower part; *Microchaetina valida* Townsend, widespread in southwestern United States, has the hind crossvein quite close to the anterior, and the few hairs of bristly size on the lower parafacial are in a single row. *Microchaetina arida* is from Peru.

Aglummyia Townsend, Proc. U. S. N. M., XLIII, 1912, p. 354. Type and sole original species, *percinerea*, new species, from Peru. Variety *flavida* Townsend, Jour. N. Y. Ent. Soc., XXIII, 1915, p. 66, also from Peru.

Microplagia Townsend, Proc. U. S. N. M., XLIX, 1916, p. 437. Type and sole original species, *nitens*, new species, of Peru.

Opsidiopsis Townsend, Proc. U. S. N. M., LVI, 1919, p. 544. Type and sole original species, *oblata*, new species. (Syn. *Chaetoplagia modesta* Reinhard, Annals Ent. Soc. Amer., XIV, 1921, p. 334). New Mexico; Texas.

Phoeniciomyia Townsend, Jour. N. Y. Ent. Soc. XXIII, 1915, p. 231. Type and sole original species, *arizonica*, new species, from Arizona.

Plagimasicera Townsend, Proc. U. S. N. M., XLIX, 1915, p. 411. Type and sole original species, *petiolata*, new species, from Peru.

Plagiomima Brauer and Bergenstamm, Zweifl. Kais. Mus., V, 1891, p. 384; VI, 1893, p. 138. Type and sole original species *disparata*, new species, of Mexico.

Siphoplagia Townsend, Trans. Amer. Ent. Soc., XVIII, 1891, p. 349. Type and sole original species *anomala*, new species, of New Mexico.

Siphoplagiopsis Townsend, Insecutor Ins. Menst., IV, 1916, p. 123. Type and sole original species, *similis*, new species, of Maryland. (The key to *Plagiomima*, with new species, will be found at the end of this paper).

Plagiprospherysa Townsend,[2] Trans. Amer. Ent. Soc., XIX, 1892, p. 113. Type and sole original species, *valida*, new species, equals *parvipalpis* Van der Wulp, widespread in North America.

Tachinopsis Coquillett, Revis. Tachin., 1897, p. 120. Type, *mentalis*, new species, equals *parvipalpis* Van der Wulp.

Plagiops Townsend, Insecutor Ins. Menst., IV, p. 57, 1916. Type and sole original species *meridionalis*, new species, from Peru, very close to *parvipalpis* Van der Wulp. *Plagiops littoralis* Townsend, from Miami, Florida, a second North American species, differs from *parvipalpis* in smaller size, more vivid black and white coloring, and the scutellum wholly black.

Stomatomyia Brauer and Bergenstamm, Zweifl. Kais. Mus., IV, 1889, p. 98; VI, 1893, p. 124. Type and sole original species, *Chetogena filipalpis* Rondani of Europe.

Taxigramma Perris, Ann. Soc. Linn. Lyon, 1850 (1852), p. 209. Type and sole original species, *pipiens*, new species, equals *Miltogramma heteroneura* Meigen, European.

Heteropterina Macquart, Ann. Soc. Ent. France, 1854, p. 426. Type and sole original species, *Miltogramma heteroneura* Meigen.

Nasonimyia Townsend, Proc. U. S. N. M., 1916, p. 619. Type and sole original species, *Heteropterina nasoni* Coquillett, equals *heteroneura*, of North America. Widespread.

Uclesia Girschner, Wien. Ent. Ztg., XX, 1901, p. 69. Type and sole original species, *fumipennis*, new species. Herein described, *retracta*, new species, from Washington.

Voria Robineau-Desvoidy, Myodaires, 1830, p. 195. Type and sole original species, *Tachina ruralis* Meigen, of Europe.

Plagia Meigen, Syst. Beschr., VII, 1838, p. 201. Type *Tachina verticalis* Meigen, equals *Tachina ruralis* Meigen. Our North American widespread species *americana* Van der Wulp (*aurifrons* Townsend) is a synonym of *ruralis* Meigen.

Xenoplagia Townsend, Insecutor Ins. Menst., II, 1914, p. 13. Type and sole original species *setosa*, new species, of Peru.

[2] If Plagiprospherysa can be maintained on absence of discals, bare eyes, and slight palpal characters as distinct from Stomatomyia Brauer and Bergenstamm, it will include *Stomatomyia acuminata* Rondani and *media* Rondani of Europe.

OPSOPHAGUS new genus

A Peruvian genus, superficially resembling Nephoplagia Townsend in having very striking spots on the wings, a row of bristles extending down the parafacials, and discal abdominal bristles; but differing in having the first vein setulose, and in specific characters. Eyes entirely bare in the type species, thinly hairy in the other one.

Chaetotaxy of head: ocellar bristles are developed, proclinate and divergent, two large verticals, two large proclinate orbitals followed by two smaller, two larger than the latter and one smaller forming a row which extends down the parafacial almost to the lower edge of the eye; there are a few small hairs mixed in this row. Frontals about 7, the upper pair large, reclinate and divergent, the next two pairs also reclinate, the remainder decussate except the lowest one; cheek nearly one-half the eye height. Third antennal joint moderately elongated, widened apically, one and one-half times the second; basal joint of arista a little elongated. Face flat, not protuberant below, the ridges bare, vibrissae at oral margin; palpi normal; proboscis short, fleshy. Chaetotaxy of thorax: acrostichal 3 : 3; dorsocentral 2 : 3; humeral 4; posthumeral 1; presutural 2 (the inner small); notopleural 2; supraalar 3 (the anterior one minute, the second large); intraalar 3; postalar 2; scutellum with two lateral, a large decussate apical, an erect pair just before and almost between the latter, and several erect discals; sternopleural 2 : 1; pteropleural 0. Costal spine distinct, last section of fifth vein barely more than one-half the preceding; fourth vein with rectangular bend, the first posterior cell open in the costa considerably before the apex.

Genotype: *Opsophagus ornatus* new species.

Opsophagus ornatus new species

Male.—Front .37 of the headwidth, with brown pollen which in certain angles shows white reflecting spots; parafacials, face and cheeks silvery; antennae black, the second joint rather brown. Palpi brownish-yellow. Thorax black in ground color with a coppery reflection on the hind part and on the scutellum; the pollen on the disk is changeable in various directions, but usually brownish; when viewed from behind there is a large central stripe of white and on each side a more or less divided black stripe, the outer part of which reappears behind the suture in an elongated triangle. The erect bristles of the scutellum include a large pair almost at the extreme apex, another pair on the middle and a smaller pair near the base. Abdomen velvety black, with a narrow silver crossband slightly interrupted on the extreme base of the second segment, and a broader uninterrupted

band on the third and fourth segments. First segment without median marginals, second segment with a large pair and some erect smaller ones, together with two slightly erect pairs of discals; third segment with a marginal row of six large bristles, a smaller discal pair, and several still smaller behind the last mentioned; fourth segment with a pair of discals almost basal in position standing in the silver crossband. A row of large bristles at the last third and a marginal row smaller. Wing slightly infuscated with three very distinct blackish spots, the first extends from the costa to the fifth vein, including the small crossvein; the second forms a broad border on the posterior crossvein and the third forms a similar border around the bend of the fourth vein. Length; 6 mm.

Described from one male, collected by C. H. T. Townsend on Huascaray Ridge, Jaen Province, Peru, September 22, altitude 8000 feet.

Type: Male, Cat. No. 28734, U. S. N. M.

Opsophagus nigripalpis new species

Male and female.—Differs from *ornatus* in having the wing-spots restricted to faint traces on the crossveins and bend of fourth vein, palpi black, eyes thinly hairy, etc. The dark body-color is not the rich *brown* of *ornatus*, but an intense black. The eye is larger, so that the cheek is hardly one-third its height. The second antennal joint is reddish-brown, and not very slender. The chaetotaxy of head and thorax is the same as in *ornatus*, except that the parafacial bristles of the present species extend farther down and are more numerous by one or two. Pulvilli of male moderately elongated; male genitalia small and retracted. Length: 5.8 to 6.8 mm.

Described from one male and two females, collected at Perales, Chili, by Father Anastasio Perion, and transmitted to the National Museum by the Chilean entomologist Senor Alfredo Faz, of Santiago.

Type: Male, Cat. No. 28849, U. S. National Museum.

HYLEORUS, new genus

Eyes hairy; the facial ridges bristly more than half way, or just to lowest frontal; parafacials and cheeks narrow; third antennal joint more than twice the second; arista short with elongated penultimate joint; frontals all reclinate, the uppermost minute. Ocellars small, proclinate. Proboscis and palpi of ordinary form. First and third veins of wings setulose, the latter almost to tip;

last section of fifth vein about as long as preceding. Bend of fourth vein with a long fork extending nearly to the margin but becoming thinner, the first posterior cell open decidedly before apex. Second and third and abdominal segments with discal macrochaetae, no pteropleural.

Hyleorus furcatus new species

Female.—Front .33 of the headwidth in the single specimen, widening very little to the lower edge of the eye. Parafrontals plumbeous with sparse hairs, three large proclinate orbitals and about six frontals, the lowest of the latter is about at the level of the arista and is reclinate; there are two verticals as usual. Parafacials silvery, very narrow in their lower part, bare below the frontals. Antennae blackish, the second joint more reddish towards its tip and rather remarkably slender, although short; the third joint reaches almost to the edge of the mouth, where the vibrissae are located. Cheek about one-tenth the eye height; palpi yellowish, proboscis small, fleshy, the labella yellowish in front. Thorax with cinereous pollen showing when viewed from behind, the usual four shining black stripes of which the inner are slender and abbreviated. Chaetotaxy: acrostichal 3 : 3; dorsocentral 3 : 3; humeral 3; posthumeral 2; presutural 2, the inner small; notopleural 2; supraalar 2, the anterior large, the posterior small; postalar 2, the inner large; sternopleural 3; scutellum with two marginals and a decussate apical pair not much more than half as long as the adjacent long marginals. Disk of the scutellum with several erect spines, the posterior pair of which are just in front of and between the apicals.

Abdomen rather narrow in form, not shining, black with silvery pollen on the bases of segments two, three and four, occupying in various lights from one-fourth to nearly one-half of the segment; the second segment has two pairs of discals, one before the other, and a pair of median marginals with a small pair of bristles outside of these; the third segment has two pairs of discals like the second, but several erect smaller bristles alongside them together with a marginal row of about a dozen extending to the middle line below, the abdomen being somewhat compressed toward the tip; the fourth segment with numerous short erect, stiff bristles beginning near the front edge, and a row of about eight large erect bristles a little before the hind margin.

Legs black, middle tibia with three or four bristles on the outer front side; hind tibia with an irregular row on the outer hind side. Front tarsi not flattened; pulvilli small. Wing hyaline, costal spine distinct but not large. Venation as already mentioned. The distance of the fourth vein from the crossvein to the bend is less than the distance from the bend to the tip. The hind

crossvein joins the fourth vein nearer to the small crossvein than to the bend, the costal segment between the auxiliary and the first vein is very short. Length: 5.8 mm.

Described from one female specimen, collected by A. P. Dodd, at Cairns, North Queensland, Australia.

Type: Female, Cat. No. 28735, U. S. N. M.

STHENOPLEURA new genus

First, third and usually the fifth vein setulose. Parafacials with minute hairs. Last section of fifth vein slightly longer than the preceding. Hind crossvein very oblique, joining the fourth vein at two-thirds the distance from the small crossvein to the bend, the latter having a long branch; the main part joining the costa far before the tip and equalling in length the distance on the fourth vein from the small crossvein to the bend. First posterior cell open or barely closed in the costa. Palpi and proboscis normal.

Chaetotaxy: ocellars large, strongly divergent, only slightly proclinate, two large verticals in both sexes. Six frontals, the upper pair reclinate and diverging, only one reclinate below the insertion of the antennæ. Three pairs of orbitals in both sexes. Thorax: acrostichal 3 : 3; dorsocentral 3 : 3; humeral 3; posthumeral 2; presutural 2; notopleural 2; supraalar 3 (the anterior and posterior small); intraalar 3; postalar, one very large and one very small; scutellum with two large lateral (the second very large), one large decussate apical and several irregular upright discals of varying sizes; sternopleural 3; pteropleural 1, very large. Abdomen: no median marginals on first segment, one pair on second, third with a row of eight, fourth with a discal row of eight or ten considerably beyond the middle, at the tip only with small depressed bristles.

Face rather flat, not depressed in the middle, slightly projecting below, the ridges bare. Antennae reaching three-fourths of the way to the vibrissae, which are at the oral margin; penultimate joint of arista distinctly elongated; cheeks bare, about one-third the eye height.

Genotype: *Sthenopleura latifrons* new species.

Sthenopleura latifrons new species

1897. *Siphoplagia rigidirostris* Coquillett, Revision of N. A. Tachinidae, p. 78.
Paraplagia rigidirostris Van der Wulp of authors.

Male.—Head very wide, .46, .48, .48 of the headwidth in three specimens; silvery pollinose below the level of the antennae, slightly yellowish above. Antennae with basal joints red, base of third sometimes also reddish; arista short, not longer than

third joint, thickened almost to the tip; palpi yellow. Thorax with gray pollen, very indistinctly striped.

Abdomen broadly cinereous pollinose on second, third and fourth segments, the pollen fading out posteriorly so that the apical third or more is shining. Venter almost devoid of pollen. Genitalia dark brown, the inner forceps very slender and close together, the outer flat, shining, triangular with a very distinct hook curving forward at tip.

Legs black with strong bristles; middle tibia with several alternating large bristles on the outer front side; hind tibia with a similar row on outer hind side. Wing hyaline. Costa slightly concave beyond the tip. Calypters white.

Female.—Front wide, .44, .47, .48 of the headwidth in three specimens. Abdomen without piercing apparatus.

Length, 6.8 to 7.5 mm.

Described from eight males and seven females; one male and two females, including the type, are from Koehler, New Mexico, (W. R. Walton); one male and two femeales, Colorado, (C. F. Baker Nos. 1601, 2019, 2030); one female, woods near Reubens, Idaho, June 14, 1909, (Aldrich); one female, Brookings, South Dakota, June 18, 1891, (Aldrich); two males and one female, Lafayette, Indiana, (Aldrich); one male, Darby, Pennsylvania; one male, Manayunk, Pennsylvania; one female, Riverton, New Jersey; one male, Potomac Run, Virginia (W. L. McAtee); one female, San Pedro, Madero, Chihuahua, Mexico, (C. H. T. Townsend); one male, Las Visayas, Mexico, August 27, 1909, (C. H. T. Townsend).

Type: Male, Cat. No. 28736, U. S. N. M.

I do not think this can be Van der Wulp's *Plagia rigidirostris*[3] from Mexico, as that species is stated to have a longer proboscis, and the hind crossvein joining the fourth vein much nearer the anterior crossvein than the bend. I do not know any species agreeing with these characters.

Coquillett reported the present species from Toronto, Canada, and Colorado. It was also recorded (as *rigidirostris*) from New Jersey by Johnson in his 1899 list of the Diptera of that state.

[3] Biologia, Dipt., vol. 2, 1890, p. 102.

MELETERUS new genus

Parafacials with bristles and hairs. First, third and fifth veins setulose. Abdomen with discals; last section of fifth vein about three-fourths as long as preceding; fourth vein with long branch to the bend; first posterior cell open in the costa far before apex.

Face receding, flat, the ridges bare; vibrissae at oral margin, lowest frontals level with tip of second antennal joint; a row of three or four downwardly directed bristles, beginning on the parafacials a little below arista. The parafacials also with several rather coarse hairs. Frontals about six, uppermost pair reclinate and diverging, but not very large; second pair reclinate and decussate; the largest pair are at the base of the antennae, they are strong and rather strikingly decussate and there is one pair below them level with tip of second antennal joint. Palpi and proboscis normal. Thoracic chaetotaxy: acrostichal 3 : 3; dorsocentral 3 : 3; humeral 3; posthumeral 2; presutural 2; notopleural 2; supraalar 3 (the first very small, the second large); intraalar 3; postalar 2 (the inner large); scutellum with two lateral and one large apical; some discals broken off, probably erect, the scars indicate a pair almost between the apicals; sternopleural 2 : 1; pteropleural 1, a little smaller than posterior sternopleural.

Genotype: *Meleterus montanus* new species.

Meleterus montanus new species

Female.—Front .40 of headwidth, the pollen distinctly yellowish on the sides, parafacials with silvery-white pollen which extends to the cheeks and posterior orbits. Antennae red as far as the arista, changing to black apically. Palpi yellow. Thorax gray-pollinose when viewed from behind, with two narrow and two wider black stripes before the suture becoming indistinct posteriorly; scutellum wholly gray. Abdomen with rather uniform thin gray pollen on the second, third and fourth segments, fading into a black band on the posterior margin. First segment without median marginals, second with a single pair, third with a median pair and at the side a group of two or three. Fourth segment a little more shining, with a discal row of eight about the middle, a few smaller irregular bristles before these and at the tip a small marginal row. Legs black; front tarsi not widened, middle tibiae with at least three large bristles on outer front side. Wing subhyaline, venation as previously described. Length, 7 mm.

Described from one female, collected by C. H. T. Townsend in the Sierra Madre Mountains, Chihuahua, Mexico, on flowers

of *Rhus glabra*, at the head of the Rio Piedras Verdes, about 7300 feet altitude.

Type: Female, Cat. No. 28737, U. S. N. M.

GINGLYCHAETA new genus

The only genus known to me which has the epistoma strongly protruding and the hind crossvein drawn in from the margin. The arista has an elongate penultimate joint, more than one-fourth of its entire length; parafacial with row of strong bristles down its middle; no pteropleural; no discals; first posterior cell open; first and fifth veins bare, third bristly more than half way to crossvein. Bend of fourth vein with strong fold or short fork.

Genotype: *Ginglychaeta seriata*, new species.

Ginglychaeta seriata new species

Male.—Front broad, in the four specimens measuring .40, .41, .42, .43 of headwidth; two large verticals; ocellars rather large, diverging laterally, not proclinate; uppermost frontal large and diverging laterally, a little reclinate; five pairs of frontals anterior to these, of which the first three are decussate and the fifth pair are a little above level of tip of second antennal joint; two or three orbitals of uneven size, almost connecting with the strong parafacial row. Antenna about as long as height of eye, the basal joints reddish-brown, third joint black, a little more than twice the second. Palpi black, proboscis ordinary, pollen of head gray.

Thorax subshining black, with indistinct black stripes. Scutellum wholly black, bearing besides two marginal pairs and one apical about ten tall upright bristles on the disk, irregularly arranged; acrostichals 3: 2; dorsocentrals 3 : 3; inner presutural two-thirds the outer; sternopleurals 3. Calypters white. Abdomen shining black, on the dorsum a white pollinose crossband on base of second, third and fourth segments. First segment with or without median marginals; second with one pair quite distinctly before hind edge; third with a similar pair somewhat separated from several at the side; fourth with discal irregular row and smaller behind. Genitalia brown, the forceps small; penis ribbon-like; fifth sternite with large smooth lobes.

Legs black, stout and bristly. Pulvilli enlarged; mid tibia with four or five bristles on outer front side. Wings brownish; costal spine distinct, first posterior cell open far before apex; last section of fifth vein fully as long as preceding.

Female.—Front .46 of headwidth; pollen of head brown above antennae. Abdomen with no indications of any piercing organ.

Length, of male 7.5 to 8 mm.; of female 8 mm.

Described from four males and one female, collected by the writer. One male was collected at Tennesse Pass, Colorado, July 24, 1917; all the rest at Marshall Pass, Colorado, July 28, 1908. One of the latter specimens was determined for me by the late D. W. Coquillet as *Paraplagia erucicola.*

Type: Male, Cat. No. 28738, U. S. N. M., from Marshall Pass, Colorado. Male and allotype female on same pin.

PAEDARIUM new genus

Agreeing in characters with Cyrtophloeba, except in having entirely bare eyes. It differs further from the American *Cyrtophloeba coquilletii* in having no discal bristles on the abdomen, but in this respect it agrees with the genotype of Cyrtophloeba. The parafacials have a row of large, downwardly directed bristles; the penultimate joint of the arista is short, the second antennal joint is two-thirds as long as the third, the male has two pairs of large orbitals. The scutellum, as in related forms, has a pair of erect bristles close together almost at the apex, in addition to the apical bristles, which are directed backward. First vein of wing bare, the third bristly to the crossvein and slightly beyond. First posterior cell open far before the apex; bend of fourth vein rectangular, with a strong fold; last section of fifth vein two-thirds of the preceding. No pteropleural bristle.

Paedarium parvum new species

Male.—Front .34 of the headwidth. General color black, the second antennal joint entirely reddish-yellow, palpi yellow, the pollen gray. Thorax cinereous with four black stripes. Chaetotaxy: acrostichal 2 : 3; dorsocentral 1 : 3; humeral 2; posthumeral 2; presutural 2 (the inner small); notopleural 2; supraalar 2; intraalar 3; postalar 2; sternopleural 2 : 1; pteropleural 0; scutellum with two marginals and an apical pair. On the dorsum besides the subapical erect pair there is a small irregular group of three smaller erect bristles on the middle of the disk.

Abdomen black, mostly shining or subshining almost to the bases of segments two, three and four; the basal pollen is denser but fades out so as to make the crossbands indefinite in width. First segment without median marginals, second with one erect pair close together, third with a larger erect pair somewhat farther apart and separated by a space from the lateral; fourth segment with a subapical row of eight large bristles and some small ones around the tip. Genitalia small, concealed.

Legs black, somewhat bristly, middle tibia with three large bristles on the outer front side; hind tibia with only a few alter-

nating large and small on the outer hind side. Claws and pulvilli rather elongated, especially the front ones. Wing evenly subinfuscated; venation as described. Length, 5 mm.

Described from one male collected at Montego Bay, Jamaica, February 6, 1912, by C. W. Johnson, to whom the specimen will be returned.

MENETUS new genus

Female.—Head large and rather square in profile; front broad; a row of four orbitals bent somewhat outward; ocellar rather erect and divergent, barely proclinate; two large verticals; eight frontals, the uppermost reclinate, one reclinate below antennal insertion; parafacials broad, distinctly hairy, some small bristles close to lower facial ridges, the latter bare; face gently concave, antennae reaching almost to vibrissae, which are at oral margin; cheeks bare, nearly half eye height; palpi normal, proboscis not elongated but decidedly slender. Post-scutellum well developed.

Thoracic chaetotaxy: acrostichal 2 : 2; dorsocentral 3 : 3; humeral 3; posthumeral 1; notopleural 2; presutural 2; supraalar 2; intraalar 3 (or 4, one side); postalar 2; sternopleural 2 : 1; pteropleural 0; scutellum with 2 lateral, 1 long decussate apical, 1 pair just before apex suberect, and 4 irregular long erect discal.

Abdomen without discals. First and third veins bare, third hairy to crossvein; last section of fifth vein at least three-fourths the preceding. Posterior crossvein joining fourth beyond middle of portion between small cross-vein and bend, the bend very oblique and bearing only a slight fold; costal spine distinct.

Type: *Brachycoma macropogon* Bigot.

Menetus macropogon Bigot

1888. *Brachycoma macropogon* Bigot, Annales Soc. Ent. France, 1888, p. 259.
1897. *Masistylum* (?) *macropogon* Brauer, Sitzungsberichte Kais. Mus. Vienna, CVI, p. 349 (sep. p. 21), [type redescribed].

Female.—Front wide (.53 of headwidth, one specimen); the dark red frontal stripe is deeply divided by the long ocellar triangle; parafacials with thin gray pollen, still thinner on parafrontals; third antennal joint black, more than twice the second, which is red but darker toward base; palpi dark brown. Thorax subshining black, with faint indications of dorsal stripes. Calypters white. Abdomen shining black with a tinge of bronze, segments two to four with rather narrow silvery basal crossband of pollen, occupying about one-third of the segment; on the third and fourth segments the band in some lights is separated along the middle from the front of the segment. Legs black,

with numerous stout bristles, front tarsi not flattened. Wing subhyaline, venation as described. Length, 7 mm.

Redescribed from a single female, collected by E. P. Van Duzee in Stone Canyon, Monterey County, California, March 27, 1919, and now belonging to the California Academy of Sciences.

I identify the species, of which this is apparently the second known specimen, from Brauer's redescription of the type. There are two slight discrepancies; Bigot calls the antennae black without mentioning the redness of the second antennal joint; and Brauer says that the vibrissae in the type are directed more downward than forward. I have never observed any muscoid fly with this character, and am inclined to think the specimen had been damaged in some way.

The presence of the post-scutellum indicates that the species is far removed from Brachycoma. Brauer compared it with Masistylum, but indicated important differences.

Goniochaeta fuscibasis new species

Female.—Front .48 of the headwidth. Greatly resembles *plagioides* Townsend in all structural details but is much darker in color, the thorax and abdomen being almost entirely black, while in the other species they are decidedly gray; the antennae are deep brown or blackish with the third segment entirely black, the last joint of the arista is strikingly short and blunt, more so than in *plagioides*. Palpi brown, more yellowish at apex. Wings uniformly infuscated, not milky as in *plagioides*. Length, 7.2 mm.

Described from one specimen collected at Laguna Beach, California (C. F. Baker).

Type: Female, Cat. No. 28739 U. S. N. M.

Euclesia retracta new species

Female.—Front .47 of the headwidth. General color yellowish-gray; ocellars well-developed, divergent and slightly proclinate; frontals about six, not very large, the uppermost pair divergent and reclinate; two orbitals. Parafacials wide with yellowish pollen; besides some small hairs there is an increasing row of bristles just outside the facial ridges, the lower ones rather large. The space next the eye has no hairs. Cheek wide with yellowish pollen, bare except where it joins the parafacial there are two or three perceptible hairs. Palpi brownish; proboscis small; antennae slender, black, except the apex of second and base of third joints; the second joint is about one-third as long

as the third; arista with penultimate joint very decidedly elongated, more than one-fourth the length of the last joint. Face receding, the central area flat, not much depressed.

Thorax almost uniformly pollinose, with a brownish tinge on the mesonotum; three posterior dorsocentrals; one presutural, the inner absent; sternopleural 2 : 1; pteropleural 0; scutellum with two lateral and a decussate apical pair, immediately in front of which there is a single median bristle, evidently an abnormality. Under the calypter, near its base, there are two or three hairs on each. Abdomen almost uniformly yellowish-gray pollinose, only a slightly denser pollen on the basal portion of the last three segments. First segment a little elongated with a weak marginal pair (only one bristle in the specimen); second segment with a marginal row widely interrupted on each side of the median pair; third segment about the same, but the row is less widely interrupted and the median pair stand considerably anterior to the margin; fourth segment with a discal row at the anterior third and a few scattering behind them. No indication of piercing apparatus.

Legs brownish; middle tibia with two bristles on outer front side; hind tibia with only a few irregular bristles on outer hind side. Wing subhyaline, the last section of the fifth vein equal to the preceding; distance between the crossveins on the fourth vein almost double the following segment; bend of fourth vein rectangular with only a slight fold. Length, 4.8 mm.

Described from one female specimen, collected by M. C. Lane, at Paha, Washington, May 7, 1920.

Type: Female, Cat. No. 28740 U. S. N. M.

PLAGIOMIMA Brauer and Bergenstamm

The references and synonymy have been given on a preceding page.

Key to the Species.

1. Apical third or more of abdominal segments 2, 3, and 4 shining black, forming evident crossbands; last joint of proboscis shorter than head height; base of third antennal joint red; pollen of face and front gray, the latter sometimes with a slight tinge of yellow; fifth vein bare (White Springs, Fla.). *alternata* new species.

   Abdominal segments 2, 3, and 4 pollinose to the tip in a favorable light, never showing distinct crossbands. . . . . 2.

2. Last joint of proboscis distinctly longer than height of head. 3.
   Last joint of proboscis shorter than height of head. . . . . 4.

3. Pollen of face gray, of front the same or with only a faint tinge of yellow (New Mexico).....*anomala* Townsend.
   Pollen of face and front golden (District of Columbia and vicinity).....*auriceps* new species.
4. Pollen of face and front decidedly golden or yellow; abdomen of female curved downward at tip in a striking manner, the fourth segment mostly shining in denuded specimens. 5.
   Pollen of face and front gray, or with only a slight yellow tinge on the front.....6.
5. Fourth segment of abdomen in female twice as long as third on the middle of dorsum (Denver, Colorado).
   abdominalis new species.
   Fourth segment of female only a little longer than the third on dorsum (Maryland, Virginia).....*similis* Townsend.
6. Fifth vein bare (Maryland to Indiana).*cognata* new species.
   Fifth vein setulose (Mexico).
   disparata Brauer and Bergenstamm.

Plagiomima disparata Brauer and Bergenstamm

I have published a note on the types in Annals Ent. Soc. America, XVII, p. 216, 1924, but unfortunately the species is not represented in the National Museum and is not now before me. I thought it barely distinct from *anomala*, but at that time did not separate the forms now regarded as species.

Plagiomima anomala Townsend

The National Museum has a series of forty-eight specimens of both sexes, all collected at Koehler, New Mexico, by W. R. Walton. These seem exactly typical. I examined the type in the Kansas collection. The perceptibly longer proboscis, gray pollen of head, and almost invariably bare fifth vein, seem distinctive. In the male genitalia the inner forceps are blackish, very slender, almost united into a single rather needle-like process which is curved forward and in cross section almost circular; the outer forceps are brown, curved forward, rounded apically but slender, and have on the outer side some subapical hair and a few large punctures. The penis, as in the other species, terminates in a long, loosely coiled ribbon, which is white with two longitudinal black lines.

Plagiomima similis Townsend

The National Museum material includes the type set of twelve females and one male, from Grove Hill and Bladensburg in Maryland; also three other females from the vicinity of Washington, and one from Clemson College, South Carolina. In the last-mentioned the fourth abdominal segment is unrubbed, and is pollinose to the tip, suggesting that the thin pollen of the segment has in the others been rubbed off in some egg-laying operation. No biological observations have been made on the species. The single male included in the type series has now no abdomen, so the genitalia cannot be examined. It looks the same as *auriceps* except in having a shorter proboscis and the head pollen yellow rather than deep golden.

Plagiomima alternata new species

Male.—The inner forceps are as described in *anomala*, but decidedly paler, generally quite yellow. The outer forceps differ in being more triangular in shape, rather sharp at tip, the front edge straight and the outer side flat and shining, not with noticeable hairs and punctures. The apical angle is acute.

Female.—Antennae slightly more slender, and the base of the third joint more reddish than in *anomala*.

Length, 6.5 to 8 mm.

Described from five males and fifty-three females, all collected at White Springs, Florida, on October 16 to 18, by Dr. and Mrs. C. H. T. Townsend.

Type: Male, Cat. No. 28782, U. S. N. M.

Plagiomima abdominalis new species

Female.—Briefly this is like *similis* except in having longer fourth abdominal segment, longer proboscis, and bare fifth vein. The last joint of the proboscis is four-fifths as long as the head-height, while it is hardly two-thirds in *similis*. Length 8.5 mm. Male unknown.

Described from a single female, collected at Denver, Colorado, on September 16, 1915, by E. C. Jackson.

Type: Female, Cat. No. 28783, U. S. N. M.

Plagiomima cognata new species

Male and Female.—The chief distinctions are in the key—the gray pollen of face and front, relatively short proboscis, bare fifth vein, and uniform pollen of abdomen. The genitalia of the

male are almost as in *anomala*, but the inner forceps are flatter behind and more curved forward. Length, 7.3 to 8.6 mm.

Described from twenty-one males and nine females, of which eight males and three females are from Lafayette, Indiana (Aldrich); eight males and two females were collected at College Park, Maryland (Walton); two males, Cabin John and Riverside, Maryland (Shannon); one male, Woodridge, D. C. (J. Silver); one female, Chesapeake Beach, Maryland (Aldrich); two females, near mouth of Fourmile Run, Virginia (McAtee); one female, Shenandoah River, Clarke Co., Virginia (Aldrich); one male, near Plummer's Id., Maryland (L. O. Jackson); and one male, Bethseda, Maryland (J. C. Crawford).

Type: Male, Cat. No. 28784, U. S. N. M., from College Park, Maryland; allotype from same locality.

Plagiomima auriceps new species

Male and Female.—The deep golden pollen of face, front and posterior orbits is the most conspicuous character. The fifth vein is setulose, the last joint of the proboscis is longer than the head height, and the pollen of the abdomen does not leave shining crossbands on segments two, three, and four, although it is more tessellated than in the other species, especially on the third segment. The inner forceps of the male are yellow, very slender and delicate; the outer are about as in *anomala*, but have a much broader and more distinct groove on the back. Length 8 to 9 mm.

Described from two males and two females. The type male is from Mathias Point, Virginia (sixty miles below Washington), and the allotype female from Cabin John, Maryland, both collected by R. C. Shannon; the allotype male is from Maryland near Plummer's Island (McAtee), while the paratype female is from the District of Columbia (Aldrich).

Type: Male, Cat. No. 28785, U. S. N. M.

ON THE HABITS AND DEVELOPMENT OF A CHECKERED BEETLE (CYMATODERA UNDULATA SAY, CLERIDAE)[1]

BY W. V. BALDUF
University of Illinois

Incident to a study of the Hymenoptera inhabiting the bur oak gall made by the cynipid, *Disholcaspis mamma* Walsh, a coleopterous larva was found that proved to be a female *Cymatodera undulata* Say, family Cleridae.[2] In their paper on the clerid larvae of North America, Böving and Champlain[3] summarize the records for this species with these statements, "Predator on wood, stem and twig borers. Reared from chestnut infested by *Callidium aerium;* maple infested by *Elaphidion;* also from sumac, wild grape, hackberry, birch, butternut, *Celastrus scandens* and *Ampelopsis quinquefolia.*" In each case mentioned, the prey is implied to be the larvae of Coleoptera, hence the discovery of this species in a cynipid gall, feeding upon the hymenopterous insects living in it, represents a habitat and habit not previously noted. The following account is a record of the observations made on the recognition marks, the development and the habits of this individual. On account of the meager studies made of this species, a general description of the larva and the pupa seems desirable.

Description of the Larva

When first found, the larva was 8 mm. long and immature. In outline the body is digitiform and dorso-ventrally flattened; color primarily purple or lavender above, the ground color of the sides stramineous, and the venter entirely of the same hue; head brown, glabrous and only about one-half as wide as the thorax and abdomen; pronotum without purple markings, and

[1] Contribution from the Entomological Laboratories of the University of Illinois, No. 98.

[2] Acknowledgement is due Mr. A. B. Wolcott for the authentic determination of this beetle.

[3] Böving, A. G., and Champlain, A. B., Larvae of North American Beetles of The Family Cleridae, Proc. U. S. Nat. Mus., Vol. 57, pp. 575–649, 1921.

the metanotum carries a median spot with its long axis cephalocaudal; abdomen with a row of subquadrangular lavender pleural markings, and the homologous thoracic markings converging irregularly with others on the nota; each notum of the abdominal segments adorned with a pair of purple patterns or designs, one on each side of the median line. The design suggests a teapot with a handle of ornamental form and broken in the middle. The spout comes off from a broad lateral projection at the bottom, and curves upward and inward almost to the top of the design. The handle side is directed towards the median line of the insect. On the dorsum of the eighth abdominal segment, the patterns are supplemented on the median line by separate patches of lavender. On the abdominal segments anterior to the seventh, these are variously modified as follows: a pair of roughly triangular spots on the sixth and fifth, a pair of dots on the fourth, third, and second, diminishing in size from the fourth to the second, and wanting on the first. The ninth bears two semicircular bands of purple and a pair of strong brown dorso-caudal hooks with tips divergent and upturned. The thoracic and abdominal pleura all bear a clump of flaxen colored bristles, and a more continuous band of them is present on the latus of the head. These bands and clumps of bristles extend cephalocaudad.

Description of the Pupa

Ground color of the newly formed pupa white; head folded under prothorax, and speckled with a moderate number of reddish-purple spots of irregular shapes and sizes; nota of thoracic segments flecked likewise, but the number of specks per segment increasing from front to back; nota of abdominal segments colored in the same hue, but spots so numerous as to make an almost solid patch of purple excepting on a narrow, mid-dorsal band and on the intersegmental membranes, which are white; ninth segment and prolegs also white. Such speckles are also present on the bases of the wing pads and sparse on the venters of the thorax; caudal hooks present, quite as on larva; length 9.5 mm.; maximum about 2 mm., abdomen tapering behind.

Examination with higher power discloses the following stramineous bristles; about twenty of different sizes on the vertex and frons; on the anterior margin of the pronotum a transverse row of fourteen mostly large bristles, and four shorter discal ones forming a square; a transverse row of twenty, located midway between the anterior and the posterior margins of the pronotum, the middle two set slightly caudad from the line; and about twenty bristles of various sizes placed rather promiscuously on the caudal half of the pronotum. Similar bristles but fewer in number, occur on the discal areas and margins of the abdominal segments.

In the course of development of this stage, the tendency is toward the appearance of more purple on the body. At the age of three days, the marginal areas of several posterior abdominal segments had purplish speckles like the discal portions of the nota. On the seventh day the eyes had turned reddish brown. When ten days old, the tips of the mandibles showed dark brown and the bases light brown through the pupal case; legs turning brown in spots, tarsal claws brown, with terminal portions darker. On the eleventh day, the normal color of the adult, but in a lighter shade, had become apparent, but the pupal case retaining its original purplish speckles throughout. The pupa stage terminated on the following or twelfth day.

Habitat and Habits

The immature larva was discovered in a bur oak gall obtained from the host tree. The average sized mature gall is about nine-sixteenths inch in diameter, and has a rough, reddish-brown surface. The central, oval case which is occupied by the cynipid gall-former or its parasites, is enclosed by a more or less pithy, woody, peripheral layer about three-thirty-seconds inch thick. The peripheral portion of the gall is inhabited by the larvae of various commensal, and it may be, parasitic Hymenoptera. In this pithy substance the clerid larva was taken, having burrowed its sinuous tunnels just below the outer surface. Although but one grub was obtained and reared to adulthood, there is evidence that this species, or others with similar habits, is not rare in this particular habitat. Not uncommonly galls of the previous year came to notice whose outer surfaces were in part broken down and characteristically tunnelled. Two other beetle larvae were encountered in the same situation, but attempts to rear them were not successful.

Both the larva and the adult are strikingly averse to light. During the course of observations, these stages were never present in the light of their own accord, and promptly betook themselves to cover of darkness when given the chance to do so. The requirements of food necessitate the passage of the larva from gall to gall, which transition is probably affected at night. It came out of its gall cavities at times when the gall was kept in a tight box which was dark as night. The adult is especially retiring and wary in its manner and inclined to rest in secluded places.

The body of the larva is adapted by its elongate and depressed form for dwelling in shallow cavities where a minimum of movement is required. It became obvious that the hooks on the ninth abdominal segment, by virtue of their divergence and upward direction, are useful in travel in the tunnels, where they probably hook into the upper wall of the burrow and seem to be employed mainly in traveling backward. When leaving one gall for another, the larva is fairly guarded against falling off the tree by the use of its tarsal claws that grip the rough bark surfaces. In all the handling of the adult, it never made an effort to spread its wings for flight.

When the original gall became useless, the larva was transferred to a large cork stopper, cut in two, and a furrow dug into the two inner faces to provide an abode for the insect. But the grub preferred a burrow of its own making and within two days made two tunnels almost the full length of the stopper and parallel with the artificial furrow, always avoiding coming to the surface, and, as far as noted, one tunnel did not run into the other. The sawdust-like material removed was thrown out at the man-made opening of the stopper, composing a heap equivalent in volume to one-half a cubic centimeter. This facility in making new cavities indicates the ability of the larva to readily reestablish itself in new galls during a few hours of the night. In the process of constructing new cavities, the caudal hooks are apparently also of use, enabling the larva to maintain a stationary position and apply its mandibles in the removal of bits of wood.

As a means of demonstrating how the clerid takes its food, a hymenopterous larva of a species that naturally occupies the periphery of the *Disholcaspis mamma* gall was inserted into its burrow in one of these galls. When the predator came upon it, its mandibles embraced it, and by a chewing action of the maxillae the body of the prey was pierced. In a few subsequent minutes the victim's body became noticeably less firm as the internal liquids were extracted. Upon relinquishing its hold with the mandibles, the beetle grub had difficulty in reassuming its grasp. The mandibles are not extraordinarily developed for seizing prey, and this condition is counterbalanced by the habit of living in burrows where the victims exist in close confinement and can be pushed against the burrow walls as an aid to grasping

them. In other words, this mandibular structure could scarcely be effective as a food getter under open conditions such as are characteristic of the tiger beetles, for example. Careful dissections of a long series of this kind of gall disclosed an approximate average of four hymenopterous larvae per gall in the peripheral portion occupied by the clerid larva. However, in a few extreme instances, the peripheries, and especially those softer portions that clasp the stem or twig, were found to be occupied by a comparatively large number of such forms, so that the minute cells of the several larvae were almost contiguous, and at times constituted two layers, one lying deeper than the other in the pith of the gall. The hymenopterous grubs become mature in the fall and hibernate in this condition, remaining thus in most cases until near the beginning of summer. They are all small, usually one to two millimeters long, and robust, occupying proportionately small oval cavities in the pithy substance of the host gall. Various families are represented by them; most of the species are Chalcidoidea, belonging to the families Chalcididae, Pteromalidae and Eurytomidae, but the largest proportion of individuals of a single species belong to the cynipid inquiline, *Synergus campanula* O.S. Some of these species may be parasitic upon the others, but whether host or parasite, the clerid predator probably does not discriminate while in the act of taking food. The numbers of the inquiline insects, therefore, would make possible the development of not a few *Cymatodera undulata* larvae, should they be present on a tree bearing an abundance of galls, such as was the case where the larva under consideration was taken. However, where only one or two inquiline larvae inhabit a gall, the burrowing effort necessary to find them is obviously a protracted and relatively fruitless task.

During the first week (May 19 to May 26, 1924) in which it was observed, the food habit of the larva was not known, and it shrunk very noticeably in size, but regained its former proportions and increased conspicuously within the next three weeks on a diet of hymenopterous larvae. During this period, (May 26 to June 22), twenty-five Hymenoptera were provided and all but a few quite promptly lost their normal resiliency, which state indicates that the body fluids had been removed by *undulata*. The rate of consuming the living Hymenoptera from June 22 to June 30, the date on which the clerid is known to have eaten last before transformation, is given herewith.

June 22. Provided twelve Hymenoptera in the original gall.

June 24. Traces of only one hymenopterous larva found. Rest seem to have been consumed bodily. Transferred larva to the cork-stopper cage, and placed there twelve inquiline Hymenoptera and twenty tiny pupae of a parasite from the central case.

June 25. None of the inquilines were recovered, but eleven parasite pupae were found again apparently uninjured. Removed the pupae, and supplied thirteen inquilines.

June 27. None of the larvae survived the predator. Added twenty more.

June 30. Five of the twenty larvae found, two of them still alive, and three almost of normal size, but had lost their elasticity.

July 1. Larva preparing for pupation.

Hence, in the last eight feeding days, *C. undulata* was given, 77 larvae and pupae, of which thirteen were recovered alive eleven of them being pupae of the parasite of the gall maker. Of the 55 peripheral larvae, traces were found of only six, two still alive. There was then an average daily consumption of about six periphery inhabiting larvae. Adding the 20 known to have been consumed previous to June 22, gives a known record of 69 peripheral larvae eaten in about twenty-six days. The *C. undulata* larva was perhaps one-half grown when found on May 19, and had therefore previously devoured a considerable number of such larvae. It is estimated that the total number required to mature this species is over one hundred. On June 30, or the date on which the larva reached maturity, the periphery inhabiting Hymenoptera, which constituted the natural food of this particular individual, were still in large part in the larval stage. The larval stage of the prey of the clerid is therefore quite closely coextensive with that of its own, which suggests the possibility that the food and habitat of this specimen may be not uncommon to this species.

The food taken by the adult under natural conditions was not determined, but it was kept alive by feedings described below for what was apparently a normal lifetime. The insect completed its transformation on July 23. Following is the feeding record made by the adult.

July 24. Placed two living adult *Diabrotica vittata* in a tight tin box which constituted the cage.

July 28. *D. vittata* dead; one with under side of head and prothorax eaten off; other with venter of abdomen gouged. Provided an adult *Diabrotica 12-punctata*, with head crushed to insure that it could be caught.

July 31. *D. 12-punctata* entirely consumed excepting chitinous portions; elytra lie apart, legs scattered, and exoskeleton of body much divided and spread about. Not fed again until August 1, then given two unmutilated adult *D. 12-punctata*.

August 2. Neither of the *D. 12-punctata* was injured, although the clerid must have been hungry from a fast of two days. It seems therefore that the predator catches less agile and perhaps smaller prey, or takes such as may be confined within the limiting wall of cavities or such other conditions occupied by it in nature. The habit of scavenger is also suggested by these circumstances. One of the above *12-punctata* was incapacitated for motion and left in the cage.

August 5. All edible parts of the beetle consumed. Remnants scattered as noted before.

August 5–August 16. No records.

August 16. Provided two incapacitated adult *D. 12-punctata*.

August 19. All edible parts of one beetle consumed, and parts of the other. Placed a living adult ladybeetle (*Ceratomegilla fuscilabris*) in the cage, and left the unconsumed *D. 12-punctata*.

August 20. Latter beetle with abdomen partly eaten off. *C. fuscilabris* wedged in cage, and had tip of elytra and small portion of tip of abdomen chewed off. Supplied another *D. 12-punctata*.

August 21. *D. 12-punctata* with all edible parts gone. Gave the predator an adult *Lema trilineata*.

August 23. *Lema* uninjured and active; was therefore made immotile.

August 30. *C. undulata* weak. Had eaten only tip of abdomen of *L. trilineata*. Provided an adult *Diabrotica longicornis*, with head crushed. *Undulata* was seen eating this beetle a few minutes later. Continued to feed when placed in the light; hunger therefore overcame its negatively phototropic tendencies.

August 31. *D. longicornis* entirely consumed. Placed a living *D. 12-punctata* in the cage, but disabled it for locomotion.

September 2. *D. 12-punctata* entirely consumed except chitinous portions. Supplied two newly killed houseflies, *Musca domestica.*

September 5. One housefly seems to have been devoured in toto; other with a hole through dorsum of thorax and all the abdomen removed. Now provided two adult Miridae, *Adelphocoris rapidus*, with heads removed.

September 9. One *A. rapidus* with entire abdomen consumed; other disturbed but slightly. Put two newly killed house-flies in the cage.

September 17. Both houseflies consumed for most part. Provided an adult lampyrid, *Chauliognathus pennsylvanicus*, rendered inactive.

September 20. *C. pennsylvanicus* was not attacked, although the clerid must have been hungry due to a period of insufficient food. Placed a newly swatted housefly in the cage.

September 23. Housefly consumed, except wings and walls of thorax. Provided another housefly.

September 27. Housefly not so completely devoured as on the 23rd instant. Two newly killed adult *Diabrotica longicornis* were made available.

October 1. *Cymatodera undulata* dead. Both *D. longicornis* intact.

During its adult existence this beetle therefore is known to have consumed entirely or in part 19 adult insects, 2 of which were *Diabrotica vittata*, 6 *D. 12-punctata*, 1 *D. longicornis*, 1 *Lema trilineata*, 1 *Ceratomegilla fuscilabris*, barely disturbed, 6 houseflies and 2 *Adelphocoris rapidus.* Most of the offerings were phytophagous insects. These were all adults, and none such as perhaps are commonly available to the predator under natural conditions. This makes an average consumption of approximately one insect each four days. If we add to this the estimated number of small hymenopterous larvae eaten by the predator larvae, a total of not less than one hundred and twenty insects of various sizes were required to mature this specimen. This fact suggests the possibility of a noteworthy economic importance if the beetle devours chiefly injurious insects on forest trees in nature.

Life Cycle

When found mining the periphery of the *Disholcaspis mamma* gall on bur oak on May 19, 1924, the larva was only about one-half grown. Only the last moult was observed. The exuvium was shriveled and much crumpled. The exit of the larva was made through a dorsal slit that extended back to about the fourth abdominal segment. The teapot-shaped color patterns of the exuvium were faint but still recognizable. The larva continued feeding until June 30, and was discovered in the process of preparing for pupation on July 1. At this time the larva occupied the cork stopper cut in halves longitudinally for use as a cage. The two portions of the stopper were glued together internally by secretions of the larva. The tunnel at either end of the larva had been closed with cork dust mixed with adhesive substances. The transforming larva had a length of 11 mm., and its abode was slightly longer. On July 7, the larva was still in the prepupa stage, but had become contracted and much more robust. It was no longer capable of locomotion, but could flip over upon its venter when disturbed by prodding. On July 9, it had become more robust and rigid, and had not yet assumed the pupal form.

By July 11, the external process of transformation was completed and the last exuvium of the larva hung on the tip of the abdomen. At this time the pupa was speckled with purplish spots of various small sizes and forms, and remained thus throughout, although later its color appearance was affected by that of the adult forming within. The pupal skin was cast between the afternoon of July 22 and the afternoon of July 23. When found, the newly developed adult still lay on its back in the pupal chamber, but when brought into the light it jumped to its feet and crawled a few steps away. It was found dead on October 1.

A summary of the known facts in the life cycle therefore show the following. The adult stage endured from July 23, 1924, to October 1, 1924, a period of seventy days. Eggs are probably deposited in sufficient time in summer or early fall to enable them to hatch and the larva to become about one-third grown before the hibernation season. The larval period in this instance lasted, it is thought, from late summer or perhaps September, 1923, to June 30, 1924, or approximately ten months. The prepupa stage continued from July 1 to July 10 or about ten days, the adult developing on July 23.

A NEW DOLICHOPODID GENUS, WITH DESCRIPTIONS OF FIVE NEW SPECIES (DIPTERA)

BY M. C. VAN DUZEE

Buffalo, N. Y.

KOPHOSOMA new genus

Small species, having the face rather wide above, narrow below, that of the female with the sides nearly parallel, but not very wide. First joint of the antennæ bare above, third joint more or less pointed at tip; short and somewhat triangular in the female, sometimes much elongated in the male; arista inserted near the base of third joint, its first joint long. Orbital cilia short and few. Acrostichal bristles well developed, in a single row. Abdomen of the male short and stout, not depressed, ending in the large, sessile, unsymmetrical hypopygium; that of the female short and stout, not tapering to a point, not depressed. First joint of posterior tarsi shorter than second.

Type of the genus: *Sympycnus falco* Aldrich.

The males are easily recognized by the basal antennal arista, taken with the short, thick body and the large, sessile hypopygium, which is decidedly unsymmetrical. The females resemble stout female *Chrysotus*, but differs in the form of the antennæ, the arista being placed near the base of the third joint, the abdomen is also more blunt at tip. The name of the genus is from *kophos* = blunt, and *soma* = body; it has reference to the short, obtuse abdomen of both male and female.

Table of Species, Males

1 Femora blackish. (New Mexico; Idaho). **fucipes** new species.
Femora wholly yellow. 2

2 First two antennal joints yellow. 3
Antennae wholly black, or brown. 5

3 Fore coxæ with three or four extremely long black bristles, (Mexico). . . . . **coxalis** Aldrich.
Fore coxæ with only rather short bristles. 4

4 Third antennal joint not over half as long as the face, (Granada). . . . . **frater** Aldrich.
Third antennal joint as long as the face, (Pennsylvania; Indiana). . . . . **bicolor** new species.

5 Fore tibiæ on the anterior surface with a row of four very stiff, stubby bristles of moderate length, (West Indies).
similis Aldrich.
Fore tibiæ without bristles, or with very minute ones.....6
6 Third antennal joint scarcely longer than the first two joints taken together.....7
Third antennal joint more than twice as long as the first two joints taken together.....8
7 Fore tibiæ with some rather long, delicate hairs on anterior surface, (West Indies).....**falco** Aldrich.
Fore tibiæ with only very short hair, (Pennsylvania; New York; New Jersey; District of Columbia)....**brevis** new species.
8 Third antennal joint nearly as long as the height of the head, curved outward like horns, (California; Idaho).
cornuta new species.
Third antennal joint nearly straight as usual, elongate triangular, (District of Columbia; Indiana; New York).
acuticornis new species.

Table of Females.

1 Antennæ partly yellow; third vein converging with fourth.
frater Aldrich.
Antennæ wholly black.....2
2 Fore tibiæ with a row of stiff bristles on anterior surface.
similis Aldrich.
Fore tibiæ without such bristles.....3
3 Fore coxæ with pale hairs and black bristles..**falco** Aldrich.
Fore coxæ with black hairs and bristles.....4
4 All coxæ more or less blackened at base.....5
Fore coxæ wholly yellow.....6
5 Third vein of wing bent backward near the tip, so as to approach fourth vein.....**fucipes** new species.
Third and fourth veins both straight and parallel, or nearly so.
brevis, new species.
6 Third antennal joint slightly longer than wide, sharply pointed at tip; third vein very little bent back at tip.
cornuta new species.
Third antennal joint not longer than wide, obtusely pointed at tip; third vein straight.....**acuticornis** new species.

Kophosoma fuscipes new species

Male: Length 2 mm. Face moderately narrow, blackish, covered with dark grayish pollen. Front opaque with brown pollen. Antennæ (fig. 1) black, third joint a little longer than the two basal joints taken together, pointed at tip; arista longer than the antenna, inserted near the base of third antennal joint, its first joint long. Lateral and inferior orbital cilia white,

rather long and conspicuous. Thorax and abdomen green, dulled with gray pollen; acrostichal bristles in a single row; abdomen short and thick, its hairs black. Hypopygium (fig. 3) black, large, with a few pale hairs, its appendages mostly concealed.

All coxæ and femora blackish, tips of coxæ, trochanters, base and tips of femora and all tibiæ yellow, still the posterior pair usually mostly brown, sometimes the lower edge of the femora are yellowish. Fore coxæ with black hairs and with several bristles near the tip. Fore tibiæ with one or two small bristles; posterior ones with three pairs of small brsitles; middle pair with a long one near basal third and a smaller one near the middle. Joints of fore tarsi are as 17–7–6–4–5; of middle ones as 25–13–9–7–7; joints of posterior pair as 16–21–13–10–8. Calypters pale yellow with a black tip and long black cilia. Halteres yellow. Wings grayish; third and fourth veins very little convergent at their tips; cross-vein slightly before the middle of the wing; cross-vein ten, last section of fifth veins twenty-five-fiftieths of a millimeter long; sixth vein distinct.

Female: A female from Idaho seems to belong here, it agrees with the males described above in general color, wing characters, and in having black hair on fore coxæ; face quite wide, colored as in the male; the antennæ (fig. 3) smaller but formed about as in the male; calypters and their cilia as in the male.

Described from four males taken at Alamogordo, New Mexico, April 30 and May 7, 1902 (Viereck and Rehn), from the collection of the Academy of Natural Sciences of Philadelphia and one female taken by J. M. Aldrich in Idaho. Type, male, in the collection of the Academy of Natural Sciences of Philadelphia; allotype, female, in the United States National Museum.

Kophosoma bicolor new species

Male: Length 1.7 mm. Face silvery white, wide above, narrow below. Front opaque with white pollen. Palpi and proboscis brown, the former with white pollen. First two antennal joints yellow, third brown, (fig. 2), about as long as the face, tapering to a point; arista inserted near basal third of third antennal joint, its first joint long; lower orbital cilia pale, composed of a few short hairs. Thorax green, dorsum dulled with thin brown pollen; acrostichal bristles in a single row; five dorsocentrals in each row; scutellum with one pair of marginal bristles; pleura more black, dulled with white pollen. Abdomen green with black hairs. Hypopygium (fig. 5) black, more yellowish at tip, its appendages pale yellow, the outer and inner pairs curved towards each other, inner ones small.

Coxæ, femora, tibiæ and tarsi yellow, last joint of tarsi a little darker; fore and middle coxæ with small black hairs. Fore tibiæ without bristles; middle ones with two long bristles on upper anterior surface; posterior tibiæ with several small bristles. Joints of fore tarsi as 13–19–12–4–5; of middle pair as 25–15–11–7–7; joints of posterior pair as 15–25–14–10–7. Calypters and halteres yellow, cilia of the former black, but it appears brown in certain lights. Wings grayish; third and fourth veins nearly parallel beyond the cross-vein, still the third vein is bent backward very slightly towards its tip; sixth vein distinct; last section of fifth vein twenty-one, cross-vein eight-fiftieths of a millimeter long.

Described from three males. One, the type, taken at Swarthmore, Pennsylvania, July 15, 1906, by E. T. Cresson, Jr. and in the collection of the American Entomological Society; one taken by Dr. J. M. Aldrich, at Lafayette, Indiana, June 27, 1916, and in the U. S. National Museum; the third was taken at Great Falls, Virginia, June 12, by Nathan Banks and is in the author's collection.

Kophosoma cornuta new species

Male: Length 1.8–2 mm. Face wide, gray; front opaque with gray pollen. Antennæ (fig. 5) black, its joints about 3–4–23 fiftieths of a millimeter long; arista 46 fiftieths of a millimeter long, inserted near the base of third joint, its first joint nearly half of its entire length; when viewed from above the antennæ curve outward, being always widely divergent. Lower orbital cilia white, short. Dorsum of thorax nearly opaque with brownish gray pollen, but sometimes showing some metallic color; pleuræ more black with white pollen; the depression on the posterior slope of the thorax conspicuous; acrostichal bristles in a single row, well developed; five dorsocentral bristles in each row; scutellum with one pair of large bristles and a pair of small hairs on the margin. Abdomen more or less green, its hairs black when viewed from above, more reddish yellow when seen from the side. Hypopygium (fig. 8) black, more yellowish towards the tip, sometimes largely yellowish brown; its inner appendages yellow, quite long, bent almost at right angles near their middle; the outer appendages small, somewhat triangular, blackish with long hairs at their tips, often only these hairs are visible.

Coxæ yellow, middle pair gray on outer surface at base; fore coxæ with a few small black hairs and several bristles on anterior surface; middle coxæ with a small thorn at tip, formed of two or more black bristles. Femora and tibiæ yellow, the former nearly bare below; middle and hind femora each with one preapical bristle. Anterior tibiæ without bristles; middle pair with two

long ones; posterior pair with several smaller bristles and near the tip several long hairs. All tarsi blackish from the tip of the first joint, still sometimes they are almost wholly yellow; posterior tarsi with several short bristles below at base, these are not as long as the thickness of the joint. Joints of fore tarsi as 18–8 7–4–6; of middle tarsi as 29–15–11–8–7; those of hind tarsi as 16–23–16–9–7. Calypters and halteres pale yellow, the former with a black tip and long black cilia. Wings grayish; third and fourth veins nearly parallel beyond the cross-vein, the third being only slightly bent back at tip, fourth vein ending in the apex of the wing; sixth vein distinct; last section of fifth vein twenty-two, of cross-vein ten fiftieths of a millimeter long.

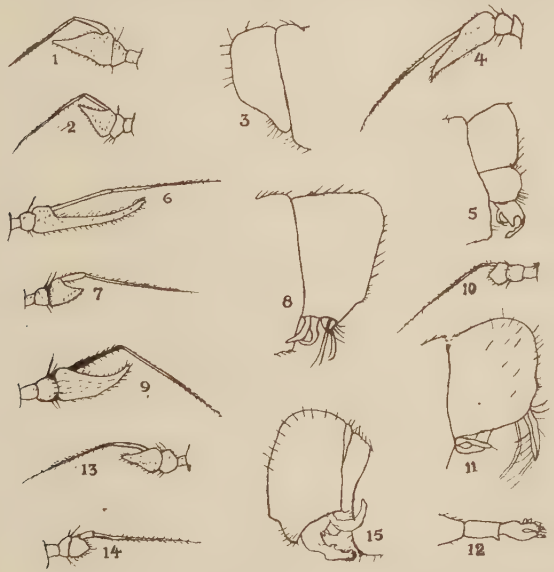

Fig. 1.—Antenna of male of *fuscipes* new species. Fig. 2.—Antenna of female of same. Fig. 3.—Hypopygium of male of same. Fig. 4.—Antenna of male of *bicolor* new species. Fig. 5.—Hypopygium of male of same. Fig. 6.—Antenna of male of *cornuta* new species. Fig. 7.—Antenna of female of same. Fig. 8.—Hypopygium of male of same. Fig. 9.—Antenna of male of *acuticornis* new species. Fig. 10.—Antenna of female of same. Fig. 11.—Hypopygium of male of same. Fig. 12.—Oviposita of female of same. Fig. 13.—Antenna of male of *brevis* new species. Fig. 14.—Antenna of female of same. Fig. 15.—Hypopygium of male of same.

Female: Colored as in the male; Face a little wider, face and front opaque with grayish brown pollen; third antennal joint (fig. 7) short, triangular; arista about as long as the height of the head; legs and feet about as in the male, but the bristles at base of hind basitarsus smaller and more hair-like. Abdomen short and thick, yellow at tip when viewed from the rear.

Described from fifteen males and one female. I took eleven males and the female at Los Angeles, California, April 29 to May 3, 1915 and one male at Fresno, California, May 6; Dr. J. M. Aldrich took one male at Juliaetta, Idaho, July 9, 1902, and one at Moscow, Idaho, and Mr. Colè took one male at Corvallis, Oregon. Type and allotype in the authors collection, the Idaho paratypes are in the U. S. National Museum, and one paratype in the American Entomological Society collection.

Kophosoma acuticornis new species

Male: Length 2 mm. Face and front black with thick grayish brown pollen, the former quite wide, but narrowed below. Antenna (fig. 9) black, third joint long, pointed and upturned at tip, arista inserted near its base; first joint of arista long. Only a few small hairs visible on the lower orbits. Thorax green, dorsum dulled with brown pollen; one row of acrostichal bristles; five dorsocentral bristles in each row; scutellum with one pair of large marginal bristles. Abdomen green, its hairs mostly reddish yellow, the little bristles on the hind margins of the segments black. Hypopygium (fig. 11) black with narrow, elongated, blackish lamellæ, which have long hairs at tip; inner appendages yellow, bent near the middle.

Fore coxæ yellow with a few black hairs and bristles near the tip on anterior surface; middle and hind coxæ yellow, more or less infuscated on outer surface. Femora, tibiæ and tarsi yellow, tarsi darkened towards their tips, sometimes the posterior ones almost wholly brown; posterior basitarsus with a minute bristle at tip. Joints of fore tarsi as 21–10–7–5–5; of middle ones as 26–17–12–9–7; joints of hind tarsi as 15–24–18–11–8. Calypters yellow with a black tip and black cilia. Halteres yellow. Wings grayish; third and fourth veins somewhat bent, so as to approach each other a little beyond the cross-vein, still they are parallel at tips; last section of fifth vein twenty, of cross-vein eight-fiftieths of a millimeter long; sixth vein distinct.

Female: a female taken the same day and place as one of the males described above, has the face wide, brown; antennæ (fig. 10) with the third joint about as long as the second, pointed at tip, the arista inserted near its base; first joint of arista rather long; color about as in the males, hairs of the abdomen and legs as in the male. Abdomen rather short and thick, but tapering towards its tip, the sixth segment cylindrical, forming part of the

ovipositor, brownish yellow (fig. 12), beyond this is a pair of orange yellow lamellæ, tipped with six blunt, black projections. Wings as in the male.

Described from four males and one female taken by Dr. J. M. Aldrich. Three males were taken at Lafayette, Indiana, July 13 and 24 and one pair at Washington, D.C., July 31; and one male taken at Ithaca, New York. Type, male taken at Lafayette, Indiana; allotype, female, taken at Washington, D.C., all in the U. S. National Museum.

Kophosoma brevis new species

Male: Length 1.7 mm. Face, front, and palpi opaque with brown pollen; face narrow, wider above. Antennæ (fig. 13) black; third joint a little longer than the first two joints taken together, pointed at tip, arista inserted near the base of third joint; first joint of the arista nearly as long as the third antennal joint. The orbital cilia are represented by a few white hairs, which are small and easily overlooked. Thorax and abdomen green; dorsum of thorax dulled with brown pollen, pleura with white pollen; acrostichal bristles in a single row, well developed; scutellum with one pair of large marginal bristles; hairs of the abdomen black, still they appear reddish when viewed from the side, especially towards the posterior end. Hypopygium (fig. 15) black, more or less yellowish at apical end, its appendages yellow; there is a cluster of rather long hairs above the outer appendages, these appendages are quite long, bent and of irregular outline, there are two small, hook-like inner appendages and a middle one with several minute hairs near the middle of the apical margin.

All coxæ yellow, more or less blackened at base, anterior pair with a few black hairs on anterior surface and black bristles at tip. All femora, tibiæ and tarsi yellow, posterior tarsi more or less brown, sometimes quite blackish from the tip of the first joint, the fore and middle pairs sometimes brownish towards their tips. Joints of fore tarsi are as 16–8–6–4–5; of middle ones as 25–15–10–7–6; joints of posterior pair as 14–20–14–10–8. Calypters yellow with black tips and cilia. Halteres yellow. Wings grayish; third and fourth veins almost parallel beyond the cross-vein; last section of fifth vein twenty, cross-vein ten-fiftieths of a millimeter long; sixth vein distinct, short, nearly parallel with the wing margin.

Female: Length 2 mm. Face a little wider than in the male; third antennal joint (fig. 14) small, not longer than wide, obtusely pointed at tip; arista basal, its first joint moderately long. Color as in the male; legs and feet as in the male; wings with the last section of fifth veins twenty-five, of cross-vein ten-fiftieths of a millimeter long. Ovipositor yellowish, formed very much as in the preceding species, but usually not or scarcely visible.

Described from many males and females. I have taken specimens from the following places in Western New York: Olcott, July 10; Irving, June 30; East Aurora, July 29; Colden, July 9; Lancaster, June 22; Portage, July 20; Middleport, Aug. 10; Jamestown, June 26; also took specimens at Toronto, Ontario, July 12. J. M. Aldrich took one pair at Washington, District of Columbia, and one male at Blue Ridge Summit, Pennsylvania, Aug. 8; and one female was taken at Ithaca, New York. Type, male, from East Aurora, New York, and the allotype, female from Colden, New York, are in the author's collection. Paratypes are in the U. S. National Museum; Cornell University collection, and the collection of the American Entomological Society, at Philadelphia.

A KEY TO THE NORTH AMERICAN GENERA OF THE ACRIDINAE WHICH OCCUR NORTH OF MEXICO (ORTHOPTERA, ACRIDIDAE)

BY MORGAN HEBARD

In rearranging the author's collection of the Acridinae it was found necessary to compare in detail a number of genera, in order to determine their logical sequence. Reference to the existing keys showed not only frequent use of characters now known to be worthless, but also occasional serious inaccuracies. So confusing were the results that it was first found necessary to tabulate the characters observed for each genus, before anything like a satisfactory beginning could be made.

A number of interesting facts were in this way ascertained and as all of the genera found in the United States are represented in the collection, it appeared advisable to prepare a key, giving the more important differences noted, as well as including the genera described since the publication of the last keys.[1]

The present key will, we hope, be an aid to the student, but is by no means final. We are at present engaged with Mr. James A. G. Rehn in revising the genera under consideration, but as yet have completed the work on only a few of these.[2] Ultimately a much more satisfactory key can be prepared.

We find that a single genus, *Paropomala* Scudder, has been correctly removed to the subfamily Cyrtacanthacrinae.

In considering the characters used, the lateral or dorsal position of the lateral foveolae of the vertex appears to constitute the most useful first division, though in *Acantherus* these foveolae are less plainly visible from above than in any of the other genera assigned to that category, while in *Radinotatum* the elevation of the lateral portions of the fastigium brings the

[1] The most important of these are as follows:
1897. McNeill. Proc. Davenport Acad. Nat. Sci., VI, pp. 195 to 199.
1902. Bruner. Biol. Cent.-Amer., Orth., II, pp. 26 to 34.

[2] Those completed are *Achurum*, *Radinotatum*, *Truxalis*, *Mermiria*, *Esselenia*, *Scyllina*, *Morseiella*, *Goniatron* and *Ligurotettix*. Mr. Rehn is now preparing a revision of *Pseudopomala* and one of *Psoloessa* and *Stirapleura*.

very weakly defined lateral foveolae into view from above, though they form a right angle with the plane of the lateral portions of the fastigium.

All of the genera here considered have the male stridulating rasp on the internal surface of the caudal femora, excepting *Stethophyma*, where it is on the tegmina. The normal type found in these genera is, however, not peculiar to the subfamily, as such is also found in genera of the Oedipodinae. The development of a rasp on the tegmina also occurs in the Old World Acridine genus *Aiolopus* Fieber and in the North American Oedipodine genus *Encoptolophus* Scudder, which genera occupy an almost absolutely analogous niche in their respective faunas.

A1. Lateral foveolae of vertex forming a right angle or acute angle with the plane of the fastigium, so that they are invisible from above.[3] (Caudal femora of male with medio-longitudinal carina of internal surface minutely denticulate, this strongest meso-proximad and disappearing distad.)

B1. Antennae strongly ensiform. (Lateral carinae of pronotum parallel or weakly divergent caudad, but obsolete in some species of *Mermiria*.)

C1. Form very slender, linear. Vertex greatly produced. Dorsal length of head greater than that of pronotum. (Genicular area of caudal femora sharply produced on each side. Size medium.)

D1. Lateral portions of fastigium overhanging the lateral foveolae. Tegmina and wings fully developed. Male subgenital plate with ventral length nearly equal to that of the preceding sternite. Dorso-external genicular projection of caudal femora slightly longer than the dorso-internal. Mountains of extreme southwestern United States, southward.

1. *Achurum* Saussure

[Genotype.—*A. sumichrasti* Saussure]

[3] In *Radinotatum* the weak lateral foveolae are at right angles to the flattened lateral portions of the fastigium, which slant slightly upward toward the outer margin, so that the narrow foveolae are visible from above. In *Acantherus*, a genus belonging with others plainly referable to section AA1 of this key, the lateral foveolae are so nearly vertical that only a narrow area is visible from above. In all the other North American genera the lateral foveolae are either plainly visible from above or entirely hidden from that angle.

DD1. Lateral portions of fastigium not overhanging the lateral foveolae. Tegmina and wings greatly reduced or vestigial. Male subgenital plate with length nearly twice that of the preceding sternite. Dorso-external genicular projection of caudal femora shorter than the dorso-internal. Southeastern United States and extreme southern Texas, southward.

2. *Radinotatum* McNeill

[Genotype.—*R. carinatum* (Walker)[4]]

CC1. Form less slender, graceful. Vertex less strongly produced. Dorsal length of head less than that of pronotum.

D2. Tegminal apices oblique. Wings of male fenestrate. Genicular area of caudal femora weakly roundly produced dorsad on each side (the internal projection slightly more decided than the external. Tegmina and wings fully developed. Size large.) Southeastern Canada and eastern United States to Argentina.....4. *Truxalis* Fabricius

[Genotype.—*T. brevicornis* (Johannson)]

DD2. Tegminal apices normal, rounded. Wings of male normal, not fenestrate. Genicular area of caudal femora normal, not produced.

E1. Tegmina with adjacent, regular, longitudinal veins in proximal portion of marginal field.[5] Lateral portions of fastigium overhanging. Fastigium with a distinct medio-longitudinal carina. Male subgenital plate nearly twice as long as the preceding sternite. British Columbia and northern United States.....3. *Pseudopomala* Morse

[Genotype.—*P. brachyptera* (Scudder)]

EE1. Tegminal venation normal, with fewer veins in marginal field. Lateral portions of fastigium not overhanging. Fastigium with a medio-longitudinal carina subobsolete or absent. Male subgenital plate not as long as the preceding sternite. Southeastern, central and southwestern United States and northern Mexico.....5. *Mermiria* Stål

[Genotype.—*M. neomexicana* (Thomas)]

BB1. Antennae simple, or slightly flattened, or clavate, never decidedly ensiform.

C2. Pronotum sellate, the prozona rounding broadly into the lateral lobes, the metazona with rounded lateral shoulders. Surface hirsute. (Fastigium with apex sharply acute.)

[4] Uvarov has recently shown *Tryxalis brevipennis* Thomas to be a synonym of *Mesops carinatus* Walker.

[5] Greatest similarity to this condition is found in *Radinotatum minimipenne* (Caudell).

D3. Fastigium not strongly ascendant, with a feeble medio-longitudinal carina indicated distad. Antennae short and simple. Nacreous areas present on body and limbs. Male tegmina with marginal field fenestrate. Wings colorless. (Internal spurs of caudal tibiae slightly unequal.) Southwestern United States and northern Mexico.....6. *Bootettix* Bruner
[Genotype.—*B. argentatus* Bruner]

DD3. Fastigium strongly ascendant, not carinate. Antennae very elongate, flattened, subensiform. Nacreuos areas absent. Male tegmina with simple marginal field. Wings colored.

E2. Metazona deplanate, subequal in length to prozona. Internal spurs of caudal tibiae slightly unequal. (Wings broadly banded or solidly black to apices.) Idaho to northern Mexico.
7. *Pedioscirtetes* Thomas
[Genotype.—*P. nevadensis* Thomas][6]

EE2. Metazona with a high, inflated medio-longitudinal crest, strongly convex in profile; over twice as long as prozona. Internal spurs of caudal tibiae distinctly unequal. (Wings broadly banded.) Great Plains region from south-central Canada to Mexican line.[7].....8. *Acrolophitus* Thomas
[Genotype.—*A. hirtipes* (Say)]

CC2. Pronotum not sellate. Surface normal, smooth or very weakly hirsute.

D4. Fastigium with surface largely convex, lacking a conspicuous infra-marginal impression.

E3. Supplementary carinae absent on head and pronotum.[8] (Tegmina and wings usually somewhat reduced. Size below medium.)

F1. Lateral carinae of pronotum straight, parallel, prominent and elevated. Antennae short, subensiform. Internal spurs of caudal tibiae very unequal. Marginal field of tegmina moderately fenestrate. Form rather slender. South-central Canada southward, west to Utah, southern Nevada and southern California, south to Mexico City.....10. *Opeia* McNeill
[Genotype.—*O. obscura* (Thomas)]

[6] Examination of the type of *Pedioscirtetes nevadensis* Thomas 1873, in the National Museum, and that of *Acrocara maculipennis* Scudder 1890, in the Museum of Comparative Zoology and additional material of these species before us, shows no features warranting their generic separation. We, therefore, place *Acrocara* Scudder as a synonym of *Pedioscirtetes* Thomas.

[7] Though as yet unreported from that country, the following genera are certain to be found in northern Mexico: *Acrolophitus, Amphitornus, Acantherus, Horesidotes, Ageneotettix* and *Ligurotettix*.

[8] Though supplementary carinae appear on the pronotum in *Amphitornus*, they are sometimes absent. In that genus the equal spurs of the caudal tibiae and other features readily separate it from *Opeia* or *Phlibostroma*.

FF1. Lateral carinae of pronotum well constricted. Antennae short, slender. Internal spurs of caudal tibiae moderately unequal. Marginal field of tegmina fenestrate. Form moderately robust. Plains of southern Canada to northern Chihuahua, Mexico.....16. *Phlibostroma* Scudder
[Genotype.—*P. quadrimaculatum* (Thomas)]

EE3. Supplementary carinae present on head or pronotum or both.[9]

F2. Internal spurs of caudal tibiae equal.

G1. Marginal field of tegmina moderately fenestrate.

H1. Caudal tibiae supplied with more numerous (15 to 24) external spines. Supplementary carinae present on occiput. Antennae slender, moderately elongate, showing a trace of distal thickening in the male sex. (Lateral carinae of pronotum very feebly to moderately constricted, sometimes almost straight in the genotype.) Southern United States to the Distrito Federal, Mexico.....9. *Syrbula* Stål
[Genotype.—*S. admirabilis* (Uhler)]

HH1. Caudal tibiae supplied with fewer (12 to 15) external spines. Antennae slightly flattened, medium length. (Lateral carinae of pronotum usually absent, when present weak and feebly constricted.) Southern Manitoba and British Columbia to the Mexican line.....12. *Amphitornus* McNeill[10]

GG1. Marginal field of tegmina simple, not fenestrate. (Supplementary carinae usually feebly indicated on occiput,[11] absent on pronotum. Antennae rather short, simple. Lateral carinae of pronotum rounded, parallel or nearly so, never at all constricted.) Southern United States to Argentina.
11. *Amblytropidia* Stål
[Genotype.—*A. ferruginosa* Stål]

[9] Except sometimes in *Amphitornus*. In this genus lateral carinae are usually absent on the pronotum, while supplementary carinae are present. When the pronotal disk is solidly colored instead of striped, however, lateral carinae appear, the supplementary carinae usually disappearing. This remarkable individual variation led to the description of the synonym *Akentetus*. We are now able to add that similarly supplementary pronotal carinae are individually present or absent in *Eritettix*, *Macneillia* and *Mesochloa*.

[10] We have recently placed *Akentetus* McNeill as a synonym of *Amphitornus*. Proc. Acad. Nat. Sci. Phila., LXXVII, p. 54 (1925).

[11] Some of the species of *Amblytropidia*, including the genotype, show scarcely any trace of supplementary occipital carinae. In the species found in the United States, however, such carinae are evident, but to individually different degrees.

FF2. Internal spurs of caudal tibiae decidedly unequal. (Caudal tibiae supplied with 9 to 13 external spines.)

G2. Lateral carinae of pronotum moderately constricted.

H2. Tegminal marginal field with normal venation proximad. Pronotum with plane of disk distinctly defined from that of lateral lobes. Tegmina and wings fully developed.[12] Caudal margin of pronotal disk weakly obtuse-angulate produced. (Male antennae clavate in some species. Male tegmina with marginal field moderately fenestrate distad.) Connecticut, North Dakota, and Wyoming to Durango, Mexico.

13. *Eritettix* Bruner

[Genotype.—*E. variabilis* Bruner]

HH2. Tegminal marginal field with numerous regular longitudinal veins proximad.[13] Pronotum with disk rounding broadly and evenly into lateral lobes. Tegmina and wings much reduced, particularly in the female sex. Caudal margin of pronotal disk showing very feeble truncate production mesad. (Antennae short, subensiform.) Florida.

14. *Macneillia* Scudder

[Genotype.—*M. obscura* (Scudder)]

GG2. Lateral carinae of pronotum decidedly constricted. (Tegminal marginal field with normal venation proximad. Tegmina and wings much reduced, allowing little fenestration of the marginal field distad in males. Antennae short, subensiform. Pronotum with plane of disk distinctly defined from that of lateral lobes.) Central Texas. . . . . 15. *Mesochloa* Scudder

[Genotype.—*M. abortiva* (Brunner)]

DD4. Fastigium of vertex with surface deplanate or concave or with a conspicuous inframarginal impression.

E4. Fastigium of vertex with surface deplanate or concave, with a medio-longitudinal carina.

F3. Fastigium of vertex concave, with a medio-longitudinal carina prominent and percurrent in the male, weak in the female. Antennae medium, evenly flattened. Pronotum with lateral carinae strongly constricted. Caudal margin of pronotal disk roundly produced mesad, concave on each side. Tegmina and wings greatly reduced. (Internal spurs of tibiae moderately unequal.[14]) Coastal west-central California.

17. *Esselenia* Hebard

[Genotype.—*E. vanduzeei* Hebard]

[12] This is true for all the species found in the United States, but not for the Mexican *E. brachypterus* Bruner.

[13] Much as in *Pseudopomala*.

[14] In one specimen before us the longer of these spurs is worn down, so that they are of equal length.

FF3. Fastigium of vertex deplanate, with a weak medio-longitudinal carina best indicated distad.[15] Antennae moderately elongate, fairly coarse. Pronotum with lateral carinae nearly parallel or weakly constricted. Caudal margin of pronotal disk truncate. Tegmina and wings reduced in male, greatly reduced in female.[16] (Tegmina of male with distal portion of marginal field and humeral-discoidal area fenestrate. Internal spurs of caudal tibiae equal or moderately unequal.) Southern Canada and northern United States, in mountains south to New Mexico and Oregon.....22. *Chloealtis* Harris
[Genotype.—*C. conspersa* Harris]

EE4. Fastigium of vertex having a conspicuous inframarginal impression, lacking a medio-longitudinal carina.

F4. Antennae subensiform. Internal spurs of caudal tibiae moderately unequal. Lateral carinae of pronotum well indicated in color, but in contour obsolete on prozona and subobsolete on metazona. Marginal field of tegmina weakly fenestrate. (Pronotum with disk rounding into lateral lobes, its caudal margin very broadly convex. Surface not glabrous. Tegmina with meso-proximal convexity of costal margin normal, broad and weak. Tegmina and wings fully developed or reduced.) Plains of southern Canada to northern Chihuahua, Mexico, westward to Sierra Nevada and Sierra Madre Ranges of California.....18. *Cordillacris* Rehn
[Genotype.—*C. occipitalis* (Thomas)]

FF4. Antennae simple. Internal spurs of caudal tibiae equal. Lateral carinae of pronotum weakly to strongly developed. Marginal field of tegminal simple.

G3. Lateral lobes of pronotum curving to meet disk. Medio-longitudinal and lateral carinae of pronotal disk weaker.

H3. Lateral carinae of pronotum diverging on metazona[17] and in some species on cephalic portion of prozona. Pronotal lateral lobes deeper than long. Surface not glabrous. Structure delicate. Tegmina and wings fully developed or greatly reduced.

[15] This weak carina is occasionally absent, due to individual variation.

[16] The tegmina are rarely fully developed in the female sex of *C. conspersa*. In that species only, the tegmina have four adjacent longitudinal veins in the proximal portion of the marginal field. This is a modified condition of the type developed in *Pseudopomala* and *Macneillia*.

[17] Except in some of the tropical American forms.

Tegmina with meso-proximal convexity of costal margin broad and weak, no fenestration developed. Caudal margin of pronotal disk sharply but broadly obtuse-angulate.[18] Southern Canada to central Argentina.....19. *Orphulella* Giglio-Tos
[Genotype.—*O. punctata* (DeGeer)]

HH3. Lateral carinae of pronotum parallel. Pronotal lateral lobes longer than deep. Surface partially glabrous. Structure heavier. Tegmina and wings slightly reduced. Tegmina with meso-proximal convexity of costal margin decided; a fenestrate area present in proximal portion of distal section of discoidal field. Caudal margin of pronotal disk truncate, often showing very broad and weak obtuse-angulation. New Jersey to Texas, coastal except in south.
20. *Clinocephalus* Morse
[Genotype.—*C. elegans* Morse]

GG3. Lateral lobes of pronotum deplanate and nearly vertical, forming a right angle with the deplanate disk. Medio-longitudinal and parallel lateral carinae of pronotal disk decided. (Surface not glabrous. Structure heavier. Tegmina and wings reduced or fully developed. Tegmina with meso-proximal convexity of costal margin broad and weak, no fenestration developed. Caudal margin of pronotal disk very broadly obtuse-angulate.).....21. *Dichromorpha* Morse
[Genotype.—*D. viridis* (Scudder)]

AA1. Lateral foveolae of vertex forming an obtuse angle with the plane of the fastigium, so that they are visible from above. (Tegminal apices never oblique. Wings never fenestrate. Caudal femora with apices of genicular area and genicular lobes normal, never produced. Antennae never strongly ensiform.)

B2. Lateral carinae of pronotum prominent, parallel. (Antennae subensiform. Fastigium of vertex deplanate, with a weak medio-longitudinal carina best indicated distad. Pronotum with caudal margin of disk very broadly and feebly obtuse-angulate produced. Tegmina and wings considerably reduced. Internal spurs of caudal tibiae subequal.) Southwestern California.....23. *Napaia* McNeill[19].
[Genotype.—*N. gracilis* McNeill]

[18] In the tropical American species *concinnula* (Walker), *losamatensis* Caudell and *melanopleura* Hebard, the caudal margin of the pronotal disk is convex, in some with obtuse-angulation suggested. We find that in the male sex of all of these, unlike any of the other species which have been assigned to *Orphulella*, the caudal femora lack a denticulate carina on the internal surface. Generic separation may be necessary and the name *Linoceratium* Bruner is available.

[19] Though differing in numerous important features, *Napaia* is clearly nearer *Chloealtis* than any other North American genus.

BB2. Lateral carinae of pronotum present or absent, when present showing constriction.[20]

C3. Male stridulating rasp in normal position, on internal surface of caudal femur.

D5. Pronotum of normal form, lateral carinae present.

E5. Antennae somewhat specialized, either subensiform or clavate.

F5. Antennae subensiform. Marginal field of tegmina simple, not fenestrate. Sexes very dissimilar in size.

G4. Antennae very elongate, conspicuously subensiform. Internal spurs of caudal tibiae equal. Pronotal lateral lobes with dorsal length distinctly greater than depth. Lateral carinae of pronotum distinctly constricted, usually broadly and evenly arcuate. Caudal tibiae with 13 to 16 external spines. Southeastern Arizona, southern New Mexico and Trans-Pecos Texas to the Mexican line.....24. *Acantherus* Scudder
[Genotype.—*A. piperatus* Scudder]

GG4. Antennae of normal length, subensiform. Internal spurs of caudal tibiae decidedly unequal. Pronotal lateral lobes with dorsal length equal to depth. Lateral carinae of pronotum more strongly constricted, showing angulation. Caudal tibiae with 10 to 13 external spines. Southern Arizona and southern California to Mexican line...25. *Horesidotes* Scudder
[Genotype.—*H. cinereus* Scudder]

FF5. Antennae clavate in both sexes. Marginal field of male tegmina fenestrate. Sexes not very dissimilar in size. (Internal spurs of caudal tibiae equal. Lateral carinae of pronotal disk strongly constricted. Tegmina and wings slightly reduced or fully developed in male, decidedly reduced in female. Tegmina with a meso-proximal convexity of the costal margin. Great Plains of southern Canada to Iowa, Nebraska, Colorado and in Rocky Mountains to New Mexico.
27. *Gomphocerus* Thunberg[21]
[Genotype.—*G. rufus* (Linnaeus)][22]

EE5. Antennae simple, neither subensiform or clavate.

[20] This key covers only North American species occurring north of Mexico. Some European species of *Chorthippus*, including the genotype, have the lateral carinae of the pronotum parallel.

[21] This is a holarctic genus, but is absent from eastern North America. The species *clavatus* will probably be found to occur far northward in western arctic America.

[22] Validly selected by Kirby in 1910, Bolivar's indication of *sibiricus* (Linnaeus) in 1914 has no standing.

F6. Tegmina with marginal field of male fenestrate. (Lateral carinae of pronotal disk weakly arcuate constricted.[23])

G5. Form moderately slender. Face and eyes oblique. Internal spurs of caudal tibiae equal. Constriction of lateral carinae of pronotal disk not augmented in appearance by the color pattern. Tegmina and wings fully developed to moderately reduced in the male, decidedly reduced in the female. Pronotal lateral lobes with dorsal length equal to depth. Male antennae slightly but appreciably flattened throughout. Southern Canada and northern United States, south in Rocky Mountains to New Mexico.....26. *Chorthippus* Fieber[24]
[Genotype.—*C. albomarginatus* (DeGeer)]

GG5. Form moderately robust. Face rounded and moderately oblique, eyes almost vertical. Internal spurs of caudal tibiae moderately unequal. Actual weak constriction of lateral carinae of pronotal disk usually augmented in appearance by the color pattern. Tegmina and wings fully developed, moderately reduced or greatly reduced in both sexes. Pronotal lateral lobes with dorsal length less than depth. Male antennae less noticeably flattened throughout. Southwestern Canada to South Dakota, northern Colorado, many Great Basin mountains and the northern Sierra Nevada.
28. *Bruneria* McNeill[25]
[Genotype.—*B. shastana* Scudder]

FF6. Tegmina with marginal field of male simple, not fenestrate.

G6. Median carina of pronotum percurrent and distinct, cut only by the principal sulcus.

H4. Size small. (Lateral foveolae of vertex decided. Eyes short. Fastigial production normal.)

I1. Disk of pronotum with prozona longer than metazona.

J1. Lateral lobes of pronotum normal, so that a strangulate facies is not produced. Frontal costa deplanate, weakly impressed only toward median ocellus. Lateral carinae of pronotum very weak, strongest on metazona, often well indicated in color; constriction moderately strong, distinctly arcuate. Caudal tibiae red. Indiana to Great Plains of southern Canada to Great Basin, south to Mexican line..30. *Ageneotettix* McNeill
[Genotype.—*A. deorum* (Scudder)]

[23] This is not true of the European genotype of *Chorthippus* and other exotic species of the genus, in which the lateral carinae of the pronotal disk are parallel.

[24] This is a holarctic genus and will probably be found to occur far north in Arctic America.

[25] We find that *Platybothrus* Scudder 1898, is a synonym of *Bruneria* McNeill 1897, as its genotype, *Stenobothrus brunneus* Thomas, shows no characters warranting generic separation.

JJ1. Lateral lobes of pronotum slightly compressed, so that a moderately strangulate facies is produced. Frontal costa sulcate throughout. Lateral carinae of pronotum weak, about as prominent cephalad as caudad; constriction strong, angulate. Caudal tibiae pale, pink or very light glaucous. (Head sometimes very much larger than is usual in proportion to body bulk.) Central California.....31. *Eupnigodes* McNeill....
[Genotype.—*E. megacephala* (McNeill)]

II1. Disk of pronotum with prozona shorter than metazona. (Lateral lobes of pronotum distinctly compressed, so that a decidedly strangulate facies is produced. Lateral carinae of pronotum delicate, but more prominent than in *Eupnigodes;* constriction decided. Caudal tibiae pale, pink or buffy.)

J2. Cheeks less inflated. Frontal costa not or very shallowly sulcate. Form slender. South Dakota and Colorado, southwestward to Pacific Coast, south to Jalisco, Mexico.
32. *Psoloessa* Scudder
[Genotype.—*P. texana* Scudder]

JJ2. Cheeks more inflated. Frontal costa distinctly though broadly and shallowly sulcate. Form more robust. Southwestern Canada south to Coahuila, Mexico.[26]
33. *Stirapleura* Scudder
[Genotype.—*S. delicatula* (Scudder)]

HH4. Size large.

I2. Vertex decidedly produced. Eyes elongate. Form graceful. Organs of flight fully developed, caudate. Lateral carinae of pronotal disk moderately coarse and decidedly constricted but in caudal portion of prozona obsolete. Internal spurs of caudal tibiae very decidedly unequal, apex of the longer specialized in some species. (Frontal costa broad, plane. Lateral lobes of pronotum slightly compressed, so that a weakly strangulate facies is produced. Disk of pronotum with prozona shorter than metazona. Occiput with supplementary carinae in the only species found in the United States.) Southeastern Arizona to Argentina.....34. *Scyllina* Stål
[Genotype.—*S. cyanipes* (Fabricius)]

II2. Vertex moderately produced. Eyes short. Form robust. Organs of flight fully developed to greatly reduced, but never strongly caudate. Lateral carinae of pronotal disk weakly arcuate, constricted or absent. Internal spurs of caudal tibiae not as decidedly unequal, apex not specialized.

[26] Species assigned to *Stirapleura* have been described from Mexico, Brazil, Argentina and Chile. It appears very probable that more than one genus is represented, and we therefore do not feel able to define the southern limits of *Stirapleura* at the present time.

J3. Vertex with lateral carinae and lateral foveolae subobsolete to weakly indicated. Male tegmina fully developed to greatly reduced, always with marginal field narrowing strongly distad, humeral and discoidal veins diverging very feebly distad. Female tegmina fully developed or greatly reduced and represented by lanceolate pads. Arkansas, Nebraska and Montana southward to San Luis Potosi, Mexico.

35. *Boopedon* Thomas

[Genotype.—*B. nubilum* (Say)]

JJ3. Vertex with lateral carinae and lateral foveolae well indicated. Male tegmina reduced, with marginal field not narrowed distad, humeral and discoidal vein diverging considerably distad. Female tegmina represented by ovate pads. Southern Arizona and northwestern Mexico.

36. *Morseiella* Hebard[27]

[Genotype.—*M. flaviventris* (Bruner)]

GG6. Median carina of pronotum obsolete in caudal portion of prozona.[28] (Caudal tibiae glaucous, usually of deep shade. Lateral carinae of pronotum weak cephalad and caudad, usually obsolete between, a striking cruciform color pattern often developed. Pronotum with prozona decidedly longer than metazona or rarely of equal length. Eyes suborbicular. Fastigial production slight. Lateral lobes of pronotum slightly impressed so that a substrangulate facies is produced. Head moderately large in proportion to body bulk. Size medium small to small. Internal spurs of caudal tibiae very decidedly to moderately unequal.) Southwestern Canada to northern Zacatecas, Mexico. . . . . 37. *Aulocara* Scudder[29]

[Genotype.—*A. elliotti* (Thomas)]

DD5. Pronotum subsellate, lateral carinae absent. (Prosternum with a subpyramidal or transverse tuberculate process. Tegmina with humeral vein decidedly thickened on ventral surface. Fastigium declivent. Frontal costa very broad, very shallowly impressed to plane. Eyes prominent, projecting. Antennae short, filiform. Tegmina and wings fully developed.)

[27] Though as yet unreported from the United States, we include *Morseiella*, as large series of a species belonging to this genus have been secured by Rehn and Hebard in Arizona near the Mexican line.

[28] We find that the median carina of the pronotum is as given under G6 in rare individuals of the genus *Aulocara*. Such may be distinguished from those of the alternate category by their rich glaucous caudal tibiae and other structural differences here noted.

[29] We believe that *Aulocara rufa* Scudder has been correctly transferred to the Oedipodinae by Caudell, who has erected the genus *Heliaula* to receive that unusual species.

E6. Sexes similar. Fastigium with a faint medio-longitudinal carina distad. Metazona of pronotal disk longer, distinctly longer than prozona. Tegmina with marginal field feebly fenestrate, bisected by the mediastine vein. Rasp of caudal femora with coarser, fewer teeth. Tegmina with discoidal vein simple. Southern New Mexico and Trans-Pecos Texas to northern Zacatecas, Mexico.....38. *Goniatron* Bruner
[Genotype.—*G. planum* Bruner]

EE6. Male decidedly smaller than female. Fastigium of vertex not carinate. Metazona of pronotal disk shorter, slightly longer than prozona. Tegminal marginal field very strongly fenestrate, mediastine vein failing to reach that area. Rasp of caudal femora with finer, more numerous teeth. Tegmina with discoidal vein developed mesad as a lamellate flange on dorsal surface. Central western Nevada south to Mexican line and east to Tucson, Arizona.....39. *Ligurotettix* McNeill
[Genotype.—*L. coquilletti* McNeill]

CC3. Male stridulating rasp not on internal surface of caudal femora but on intercalated vein and adjacent transverse veinlets on dorsal surface of tegmina. (Pronotum with lateral carinae percurrent, parallel or weakly concave, constricted and diverging caudad. Antennae simple, slightly flattened throughout.[30] Tegmina with marginal field and proximal portion of discoidal field subfenestrate. Form graceful. Eyes short. Caudal femora comparatively weak. Tegmina and wings fully developed, or moderately reduced in female. Internal spurs of caudal tibiae equal. Southern Canada and northern United States to Pennsylvania, Iowa, Nebraska and in the Rocky Mountains to southern Colorado.[31]
29. *Stethophyma* Fischer[32]
[Genotype.—*S. grossa* (Linnaeus)]

[30] Suggesting those of *Chorthippus*, but proportionately not as long as those of the male.

[31] As shown by unreported series before us.

[32] Here belong the North American species which have, for a long time, been incorrectly referred to the genus *Mecostethus*.

STUDIES IN THE NEOTROPICAL HESPERIOIDEA.

PAPER I.

BY ROSWELL C. WILLIAMS, JR.

Since the publication of six papers "On the Male Genitalia of the Hesperidae of North America" by Skinner and Williams, I have continued these studies on the larger Hesperidae, occurring below the Mexican line, and have made many mounts of the male genitalia and assembled the material of such species as are represented in the collection of The Academy of Natural Sciences of Philadelphia and my own. The Academy collection, already rich in this material, has been considerably augmented in the last two years by receipt of Hesperids from collectors in Central and South America and the Antilles.

It is my intention to figure the male genitalia of such species as are available, believing that the characters here disclosed are of very great importance in the classification of the Hesperioidea. The synonymy will include reference to figures of the insects or the male genitalia, and the records will refer to material in the collections above mentioned. I hope to figure those species which have not been previously or adequately figured.

This paper will deal with the old blanket genus *Eudamus*, which perhaps should be divided into several groups. I believe that it will then be found that a number of the tailed species will fall into genera, later erected for tailless species, with which they will be found to be allied on the genitalic characters. A Genus should certainly be erected for the *asine, octomaculata* group, but as A. W. Lindsey is about to write further on the subject of the Genera of the Hesperioidea, following up his admirable paper on the type fixation, I will leave this matter to him..

The plates published here are from paintings from the insects, made by Miss Helen Winchester. All types are deposited in the collection of The Academy of Natural Sciences of Philadelphia.

Eudamus dorantes (Stoll)

1791. *Papilio dorantes* Stoll, Sup. Cramer's Pap. Exot., p. 170, Plate 39, fig. 9. (Surinam.)

1810? *Urbanus fortis proteus* Hubner [not Linnaeus], Saml. Exot. Schm., I, Plate 155, fig. 1, 3.

1867. *Eudamus amisus* Hewitson, Desc. Hesp., p. 5 [no locality given].

1869. *Eudamus protillus* Herich-Schaeffer, Corres. Blat. Regensburg, XXIII, p. 171 (Tropical America).

1875. *Eudamus amisus* Hewitson, Exot. But., text and Plate Eudamus 2, fig. 10.

1880. *Goniurus kefersteinii* Plotz, Bull. Soc. Nat. Moscow, LV, p. 11 (Caracas).

1893. *Eudamus dorantes* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 278, Plate 75, fig. 7 (♂ genitalia).

1907. *Thymele protillus* DaSilva, Lep. do Brasil, p. 118, Plate 22, fig. 76.

1921. *Eudamus dorantes* Draudt, Seitz's Macrolep., V, p. 853, Plate 160, a.

1921. *Eudamus dorantes* Skinner and Williams, Trans. Amer. Ent. Soc., XLVIII, p. 115, fig. 11 (♂ genitalia).

Typical *dorantes* has a wide range from the southern states down through Central and South America. There is, of course, considerable variation, some specimens being darker below than others and some carrying a bright violet tinge below (*amisus* Hewitson), which may fade out in old specimens.

Records:—BRAZIL: Chapada (Smith); Para; Sao Paula (Pohl); Santa Catherina. PARAGUAY: Villa Rica and Sapucay (Jorgensen). BOLIVIA: Coroico. ECUADOR: Huigra (Rhoads). COLOMBIA: Aracatata, Magdalena (Rehn); Cauca (Bonis); Muzo. BRITISH GUIANA: Bartica. DUTCH GUIANA: Paramaribo (Mayo). PANAMA: Santiago de Veraguas (Davies); Gamboa (Harrower); Gatun (Harrower); Chiriqui; David (Harrower). COSTA RICA: Alajuela (Calvert); Juan Vinas (Calvert); Guapiles (Harrower); Cartago (Gillott). NICARAGUA: Eden (Huber). HONDURAS: San Pedro Sula (Griffith). GUATEMALA: Quirigua (Rhoads). MEXICO: Progresso (Williams); Jalapa (Calvert); La Joya (Hoag); Escuintla, Chiopas (Smith); Octolan.

Race **rauterbergi** Skinner (Plate II, fig. 1)

1895. *Eudamus proteus rauterbergi* Skinner, Ent. News, VI, p. 113 (Texas and Arizona).

This form is abundant in the mountains of southern Arizona. I figure a typical specimen. It may not be sufficiently different from specimens from the type locality, presumably the coast of

Dutch Guiana, to warrant the retention of this racial name. It is, however, quite constant, there being little variation in a long series from the mountains.

Race **calafia** new race (Plate II, fig. 2)

A small series of *dorantes* from Lower California, of the size and shape of typical *dorantes*, are much lighter in color above and below. It was with these insects that Dr. Skinner compared his *rauterbergi*, considering the Californian insect to be typical. From three males (type and 2 paratypes) and one female (allotype).

Form **velinus** (Plotz)

1880. *Goniurus velinus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 9 (Bahia).
1921. *Eudamus dorantes* form *velinus* Draudt, Seitz's Macrolep., V, p. 853. Plate 160, a.

I have not seen anything that just corresponds with Mr. Draudt's interpretation of Plotz's insect.

The four following insects, *santiago*, *parvus*, *retractus* and *galapagensis*, I believe to be forms of *dorantes*. They are, however, with the exception of *retractus*, geographically isolated, so I allow them specific rank until further knowledge of their early stages will show their true status.

Eudamus santiago Lucas

1856. *Eudamus santiago* Lucas, Sagra's Hist. Cuba, VII, p. 623 (Cuba).
1862. *Goniurus cariosa* Herrich-Schaeffer, Corres. Blat. Regensburg, XVI, p. 142. (Cuba.)
1870. *Goniurus corydon* Butler, Trans. Ent. Soc. London, IV, p. 492 (Cuba).
1880. *Goniurus larius* Plotz, Bull. Soc. Nat. Moscow, LV, p. 9 (Cuba).
1890. *Goniurus corydon* Butler, Lep. Exot., p. 65, Plate 25, fig. 2.
1916. *Eudamus santiago* Holland, Ann. Carnegie Mus., X, p. 500, Plate 31, fig. 6 (Isle of Pines).
1921. *Eudamus santiago* Draudt, Seitz's Macrolep., V, p. 853, Plate 161, a.

The male genitalia of *santiago* do not differ from those of typical *dorantes*.

Records:—CUBA: Havana (Williams); Cabanas (Williams); Guantanamo (Ramsden). PORTO RICO: Abonito (Williams). HAITI: Sumana (Abbott), Port de Paix (Abbott).

Eudamus parvus Skinner (Plate II, fig. 3)

1920. *Eudamus parvus* Skinner, Ent. News, XXXI, p. 134 (St. Pierre Martinique, Antigua, Dominica).

The type of *parvus* (a ♂ St. Pierre, Martinique) is without hyaline spots, is very small and the tails are very short.

Of the paratypes one shows one faint apical dot, two show three apical dots and two show the three apical dots and a thin line corresponding with the extradiscal spot of *dorantes* and a dot above the cell representing the corresponding spot in the discal band of that species. The male genitalia do not differ from those of typical *dorantes*.

Eudamus retractus Plotz (Plate II, fig. 5)

1880. *Goniurus retractus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 9 (La Guayra, Venezuela).

A specimen from British Guiana and one from Coachi, Colombia answer the description of this insect which I figure here. The hyaline spots are very small and the tails very much attenuated, approaching *parvus* Skinner. The male genitalia are the same as those of *dorantes*.

Eudamus galapagensis F. X. Williams (Plate II, fig. 4)

1911. *Eudamus galapagensis* Williams, Proc. Cal. Acad. Sci., (4), I, p. 303, fig. 6 (Galapagos Islands).

Mr. Williams sent a paratype to Dr. Skinner. It is the size and shape of *parvus* but the hyaline spots are large and bright.

Eudamus doryssus Swainson (Fig. 1)

1782. *Papilo orion* Drury [not Cramer], Ill. Exot. Ent., III, p. 22 & index, Plate 17, figs. 3, 4 (Sierra Leone, Africa).

1831. *Eudamus doryssus* Swainson, Zool. Ill., (2), II, Plate 48, fig. 2 [♀] (Bahia).

1832. *Goniurus brachius* Geyer, Hubner's Zutr. Exot. Schm., IV, p. 8, figs. 609, 610 (Brazil).

1837. *Hesperia* (*Eudamus*) *orion* Westwood, Drury's Ill. Exot. Ent., New ed., III, p. 23, Plate 17, figs. 3, 4 (Madras!).

1880. *Goniurus nivosus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 17 [Loc.?].

1921. *Eudamus brachius* Draudt, Seitz's Macrolep, V, p. 856, Plate 160, f; form *doryssus*, Plate 161, b.

There is considerable variation in the amount of white on the inferior wings, both above and below, and in the prominence of the hyaline apical spots and discal band of the superior wing. I take the figures of *doryssus*, *brachius* and Drury's *orion* to be

typical in that the white markings are rather large (the precise outline, however, varying somewhat in specimens from the same locality and catch), and the hyaline spots and band are prominent.

Records:—Brazil. Bolivia: Coroico. Ecuador: Huigra (Rhoads). Dutch Guiana: Paramaribo (Mayo). Mexico: Escuintla, Chiopas (White).

Form **leucites** Mabille.

1888. *Eudamus leucites* Mabille, Le Nature, An. x, p. 98, fig. 2 (Colombia).

This I believe to be a variety of *doryssus*, with considerably more white on the secondaries, especially below.

Draudt has placed *leucites* Mabille under *albicuspis* Herrich-Schaeffer, in this probably following Mabille and Boullet, but the figure of *albicuspis* differs from the figure of *leucites* in that it lacks the hyaline band of the upper wing; this band being replaced by two dots near the inner margin, and the shape of the lower wing being long and pointed at the extremity, not with short tails like *doryssus*. Draudt's figure of *albicuspis*, therefore, represents quite a different species, and this conclusion is confirmed by Godman's examination of the Plotzian figure, probably the one that Draudt followed. Godman states[1]: "Eudamus *albicuspis* H.-S. (drawing no.) 95, Loc? (is) a *Thymele* (?) near *phalaecus* G. and S." *Nivosus* Plotz is left in the synonymy on the authority of Draudt.

Form **tenuis** new form

Smaller; secondaries with more slender and slightly longer tails, the white much more restricted; the apical spots restricted to one or two, and the hyaline band complete but very much reduced in width, becoming linear, the extra discal spot wanting.

Records:—Brazil: Rio Janairo (Type and allotype); Chapada, Matto Grosso. Argentina: Entre Rios. (4 males, paratypes).

Form **interruptus** new form

Ground color darker, almost black, white on secondaries as in typical *doryssus*, apical spots present, band broken into small dots and dashes, obsolescent. From San Pedro Sula, Honduras (Leinhart), one male (type). *Doryssus*, *chales* and *albimargo*

[1] Ann. Mag. Nat. Hist., xx, p. 134, 1907.

are very closely allied, if not forms of one species, but there is a difference in the shape of the projection at the end of the valve. In each case the projection from the uncus is deeply split: the aedoeagus is simple, but holds a very large, stout spine.

Eudamus chales Godman and Salvin (Fig. 2)

1893. *Eudamus chales* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 274, Plate 75, figs. 2, 3 (Acapalco, Mexico).

1921. *Eudamus brachius* form *chales* Draudt, Seitz's Macrolep., V, p. 856, Plate 160, f.

We have specimens from Mazatlan, Mexico, corresponding with the type description and figure. They are like *doryssus* except that the hyaline band is obsolete and the apical spots only indicated as one or two faint minute dots. The tegumen and aedoeagus of *chales* are identical with those of *doryssus;* the valve is provided with a somewhat shorter and broader projection.

Eudamus albimargo (Mabille) (Fig. 3)

1875. *Thymele albimargo* Mabille, Bull. Ent. Soc. France, 1875, p. CCXIII, (Panama, Colombia ?).

1891. *Goniurus albimargo* Mabille and Vuillot, Nov. Lep., p. 37, Plate 5, fig. 2 (Brazil).

1921. *Eudamus dominicus* Draudt [not Plotz], Seitz's Macrolep., V, p. 856, Plate 160, f. [*albimargo* on Plate].

The reference to *dominicus* in the Seitz work as "Bull. Soc. Moscow, p. 2, 1880." is an incorrect citation, and I cannot find a reference to *dominicus* in any of the Plotzian papers.

The male genitalia are very similar to those of *doryssus* but apparently distinct.

Records:—BRAZIL: Villa Rica (Jorgensen). BRITISH GUIANA: Bartica; Potaro. VENEZUELA: Cariaquito (Brown). COLOMBIA: Eastern part; West Cordilleras. GUATEMALA: Puerto Barrios (Rhoads).

Eudamus evenus (Menetries) (Fig. 4)

1855. *Goniurus evenus* Menetries, Enum. Corp. Anim. Imp. Petrograd, I, p. 97, Plate 5, fig. 1 (Brazil).

1890. *Goniurus evenus* Mabille and Vuillot, Nov. Lep., p. 32, Plate 4, fig. 7 (San Paula, Brazil).

1921. *Eudamus evenus* Draudt, Seitz's Macrolep., V, p. 856, Plate 161, c.

Fig. 1. *Eudamus doryssus* Swainson, Chapada, Brazil. 2. *Eudamus chales* Godman and Salvin, Mazatlan, Mexico (valve). 3. *Eudamus albimargo* Mabille, Cariaquito, Venezuela. 4. *Eudamus evenus* Menetries, Chapada, Brazil. 5. *Eudamus virescens* Mabille, British Guiana. 6. *Eudamus motilones* Williams, Venezuela.

The male genitalia resemble those of *doryssus* and *albimargo*. The projecting beak of the uncus is more deeply incised and the projection from the valve is provided with long teeth. The aedoeagus is simple, carrying no floating spines.

Records:—BRAZIL: Chapada (Smith). ECUADOR: Huigra (Rhoads).

Eudamus virescens Mabille (Fig. 5)

1877. *Eudamus virescens* Mabille, Bull. Soc. Ent. France, 1877; p. 39. (Cayenne).

1880. *Goniurus herophilus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 16. (Rio).

1890. *Eudamus virescens* Mabille and Vuillot, Nov. Lep., p. 14, Plate 2, figs. 6, 7.

1921. *Goniurus herophilus* Draudt, Seitz's Macrolep., V., p. 856, Plate 161, b.

This species resembles *doryssus* or *albimargo* but there is considerable dark green shading on the wings above.

The male genitalia are characterized by the deeply cut widely separated projections of the uncus, and the deep stout scaphium. There are minute serrations on the entire terminal part of the valve. The aedoeagus carries a single stout spine.

Both Godman and Draudt consider *virescens* and *herophilus* to be synonymous.

Records:—ARGENTINA: Entre Rios. PARAGUAY: Villa Rica (Jorgensen). BRITISH GUIANA. BOLIVIA: Coroico; Rio Sango. COLOMBIA: Eastern part. FRENCH GUIANA.

Eudamus motilones, new species (Plate II, fig. 6 and Fig. 6)

Wings above, uniformly dark brown, the spots of the lower wing below faintly indicated above. A well defined costal fold and very short tail (3 mm.). Upper wing from body to apex 20 mm., lower wing from body to outer margin 13 mm.; to tip of tail 20 mm. Fringes brown. Upper wing with hyaline spots, a discal band of two costal dots, a cellular line and a larger spot constricted centrally. Beyond this band toward the outer margin a narrow rectangular spot; four small discal spots, the first three triangular, then two rectangular dots in a line, followed by a line slightly removed outward.

Wings below, light brown with darker, ill defined spots and bands. Upper wing with darker central portion and two darker spots toward the apex; hyaline spots repeated; lower wings with bands as in *eurycles*, basal band ending in two costal spots; an extra discal band, and the outer border and tail dark.

This insect has the appearance of a short-tailed *simplicius*. The male genitalia, however, are quite different; the valve ending in two arms, strongly toothed on their dorsal border.

Described from 1 ♂ from Venezuela.

Named for a Carib tribe of Indians in Venezuela.

Eudamus marmorosa (Herrich-Schaeffer) (Plate II, fig. 7 and Fig. 7)

1865. *Goniurus marmorosa* Herrich-Schaeffer, Corres. Blat. Regensburg, XIX, p. 56 (near Habana, Cuba).

This rare Cuban species has not been previously figured. The male genitalia has a split uncus, scaphium serrated above, the valve rounded externally, and with a toothed inward projection; the aedoeagus carries a single tooth, all placing it in the *proteus* group.

Eudamus myrto Mabille (Plate II, fig. 8 and Fig. 8)

1904. *Eudamus myrto* Mabille, Wytsman's Gen. Ins., Lep., Hesp. p. 21 (Haiti).

There is a single specimen in the Academy collection from Haiti. The male genitalia indicate that it belongs with *marmorosa* rather than with *alcaeus*. The uncus ends in a double beak, and the scaphium is stout and shagreened above. The valve ends in an upturned, simple hook.

Eudamus proteus (Linnaeus) (Figs. 9, 10, 11)

1758. *Papilio proteus* Linnaeus, Syst. Nat., Ed. 10, p. 484.
1872. *Thymele domingo* Scudder, Rep. Peabody Acad. Sci., IV, p. 69 (Haiti).
1830. *Goniurus proteoides* Plotz, Bull. Soc. Nat. Moscow, LV, p. 11 (North America).
1889. *Eudamus proteus* Scudder, But. New England, II, p. 37 (♂ genitalia).
1893. *Eudamus proteus* Godman & Salvin, Biol. Cent.-Amer., Rhop., II, p. 277, Plate 75, fig. 6 (♂ genitalia).
1922. *Eudamus proteus* Skinner & Williams, Trans. Amer. Ent. Soc., XLVIII, p. 114, fig. 10 (♂ genitalia).

The name *proteoides* has been applied to *proteus* from Cuba, on the grounds that the hyaline spots are smaller. It was, however, described from North America, not necessarily Cuba, and the males of this species usually have the hyaline spots smaller than those of the females, so I believe that Plotz, who put much stress on the spots, had before him females as *proteus* and redescribed the male. As to *domingo*, Godman states that it looks like

esmeraldus, but is probably *proteus*. If it is desirable to use a racial name for the Insular form I believe *domingo* should be adopted.

The male genitalia, however, of the Cuban and Haitian insects are close to *proteus*, and not like those of *esmeraldus*. The male genitalia are figured to show variation in the valvae and for comparison with those of the allied species or forms.

Records:—MEXICO: Mexico City (Williams); Escuintla, Chiopas (Smith); Vera Cruz; Colima; Cordoba. GUATEMALA: Puerto Barrios and Quirigua (Rhoads). HONDURAS: San Pedro Sula (Leinhart). COSTA RICA: Cartago (Gillott). PANAMA: Chiriqui; Santiago de Veraguas (Davies); Gatun, Canal Zone and David (Harrower). CUBA: Cabanas, Havana (Williams). JAMAICA: Bath (Swainson); Port Morant. HAITI: Port au Prince (Hughes). GRAND CAYMAN ISLAND: Gouvernors Harbour. ELEUTHERA. ANTIGUA: English Harbour (Geddes). MARTINIQUE: Mt. Pelee, St. Pierre (Porter). TORTUGA ISLAND (Abbott). COLOMBIA: Flores (Viereck); Muzo. BRITISH GUIANA: Bartica. DUTCH GUIANA: Paramaribo (Mayo). ECUADOR: Huigra (Rhoads). BRAZIL: Para; Sao Paulo (Pohl); Chapada, Matto Grosso (Smith). ARGENTINE: Entre Rios. PARAGUAY: Sapucay and Villa Rica (Jorgensen). BOLIVIA: Coroico; Rio Sango.

Eudamus esmeraldus Butler (Figs. 12, 13)

1877. *Eudamus esmeraldus*, Butler, Trans. Ent. Soc. London, 1877, p. 146. (Amazons Valley, Villa Bella).

1893. *Eudamus esmeraldus* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 278, Plate 75, fig. 6 (valve).

This insect very closely resembles *proteus* Linnaeus and can hardly be distinguished except by the male genitalia. In Paraguay whence we have series of both, *esmeraldus* seems to be smaller in size and the overlying color is bluer in *esmeraldus* and greener in *proteus*. The tegumen and aedoeagus in the two species or forms are very similar, the differences being in the valvae which in *esmeraldus* are provided with an arm on the ventral side just within the external termination. In most specimens the valvae are asymmetrical, and I figure those of two specimens, the first showing extreme asymmetry, the projection on

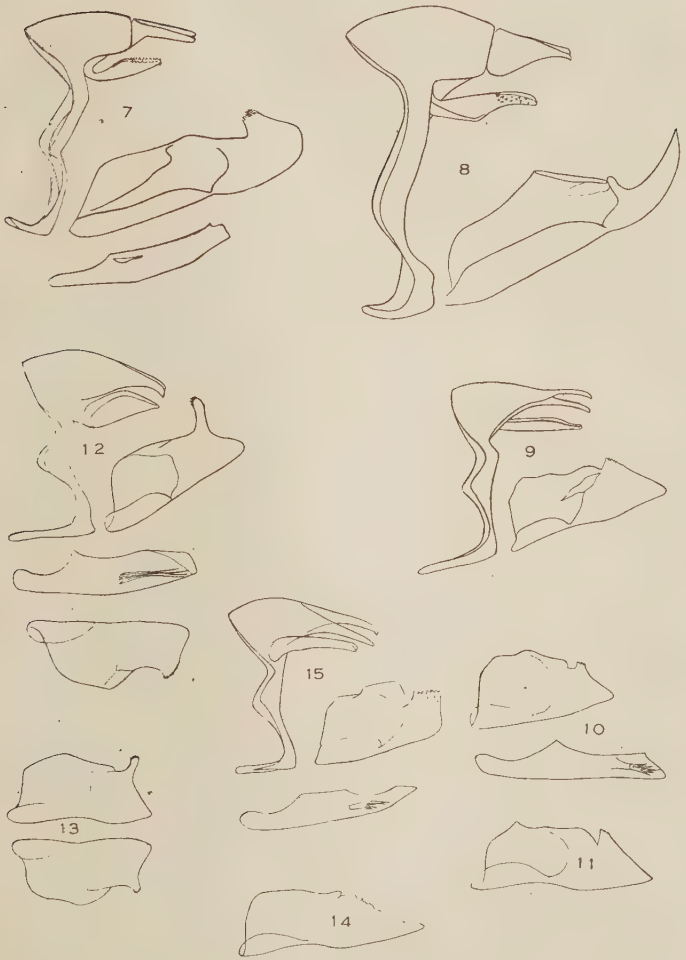

Fig. 7. *Eudamus marmorosa* Herrich-Schaeffer, Cuba. 8. *Eudamus myrto* Mabille, Haiti. 9. *Eudamus proteus* Linnaeus, Sapucay, Paraguay. 10. Same, West Indies (valve and aedoeagus). 11. Same, Huigra, Ecuador. 12. *Eudamus huancavillcas*, Williams, Huigra, Ecuador.

Fig. 13. *Eudamus esmeraldus* Butler, Sapucay, Paraguay (asymmetrical valvae). 14. Same (another pair) Sapucay, Paraguay. 15. *Eudamus acawoios* Williams, Potaro, British Guiana.

the left valve being unusually long and that of the right valve being close to that of *proteus*.

Records:—PARAGUAY: Sapucay and Villa Rica (Jorgensen). COLOMBIA: Muzo; Cauca. BOLIVIA: Corioco; Rio Sango. PANAMA: Cascades, Canal Zone. COSTA RICA: Cartago (Gillott).

Eudamus huancavillcas new species (Plate III, fig. 3 and Fig. 14)

Above like *proteus*, Linnaeus, the spots rather large and with a slightly yellowish tinge. Below, the secondaries have two brown bands shading into the violetish-gray ground color.

The tegumen and aedoaegus are the same as *proteus*. The valve ends in a long pointed acute triangle, the dorsal border strongly serrated its entire length, the cleft on the dorsal border just within this is not so deep or accentuated as in *proteus*.

From 1 ♂ Huigra, Ecuador (Rhoads). It appeared with a long series of typical *proteus*. The underside is, however, conspicuously different in the absence of the two subbasal spots, the violet gray basal color of the under wings below, light brown in *proteus*, and in the fact that the brown bands dissolve gradually into the ground color, these bands in *proteus* being distinctly defined and the upper one like a series of distinct spots.

Godman and Salvin[2] state that "*proteus* presents itself in two forms almost wherever it is found. In one, the typical form, the inner of the two dark bands beneath is split up near the costa into two isolated spots, which lie just below the costal nervure. In the other this band is entire and widens out on reaching the costal nervure, and at most shows a small cleft along its costal border. This difference is not sexual as we have males of both forms. As these present no difference in their male genitalia we do not think they can belong to different species."

In a long series of several hundred *proteus* from the United States far south to Argentine and through the Antilles, I have not seen another individual that does not at least indicate the two subcostal spots, so the condition is probably rarer than would be indicated by the above statement. In a number of genitalic mounts of *proteus* from widely separated localities I find that the continental insects have a somewhat longer tip to the valve than the insular ones, where this tip is somewhat blunter, in each

[2] Biol. Cent.-Amer. Rhop., II, p. 277, 1893.

case, however, with but little individual variation. The much longer terminal of the valve in this case, with no connecting form, seems to me to have as much significance as the difference in this organ between *proteus* and *esmeraldus*, but it and *esmeraldus* may turn out to be but forms of *proteus*.

This insect is named for a Kechua tribe of Indians occupying the type locality.

Eudamus acawoios, new species (Plate III, fig. 4 and Fig. 15)

Similar to *proteus* but smaller. Head and body bright dark green, wings brown with green hairs at base of primaries and base and disc of secondaries. Hyaline spots distinct, white, and small. Wings below marked as in typical *proteus*. Expanse 35 mm. Length of primary wing, thorax to tip, 19 mm. Length of tail, 8 mm.

The tegumen is similar to that of *proteus*, the saccus, however, shorter. The valve differs considerably. It ends in a truncate upward projection serrated on the dorsal edge and carrying additional teeth for some distance below. The aedoeagus is similar to, and carries a tuft of spines like that of *proteus*.

From 1 ♂, Potaro, British Guiana.

The striking difference in the valve, I believe, warrants the description of this insect, which, however, may be but a form or aberration of *proteus*.

This species is named for a Carib tribe of Indians occupying the type locality.

Eudamus chalco (Hubner) (Fig. 16)

1823. *Goniurus chalco* Hubner, Zutr. Exot. Schm., II, p. 22, figs. 313, 314 (Brazil).
1831. *Eudamus agesilaus* Swainson, Zool. Ill., (2), II, Plate 48, fig. 1 (Bahia).
1888. *Thymele chalco*, Staudinger, Exot. Schm., I, p. 290, Plate 98, fig. 2.
1893. *Eudamus chalco* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 275, Plate 75, fig. 4 (♂ genitalia).
1921. *Eudamus chalco* Draudt, Seitz's Macrolep., V, p. 856, Plate 160, f.

The projection from the uncus is long, slender and deeply bifurcate. The scaphium is simple but stout. The valve is triangular at its extremity. The aedoeagus carries a long slender spine. In general the male genitalia resemble those of the *proteus* group.

Records:—Brazil: Chapada (Smith). Colombia: Muzo. Panama: Canal Zone (Harrower); Santiago de Veraguas (Davies).

Eudamus harpagus Felder (Fig. 17)

1867. *Eudamus harpagus* Felder, Reise. Novara, Rhop., p. 508, Plate 70, figs. 11, 12 (New Grenada, Bogota).

1921. *Eudamus harpagus* Draudt, Seitz's Macrolep., v, p. 855, Plate 160, e.

The uncus is stout, with the two projections widely separated, the scaphium strong, short, and finely shagreened. The valve ends in an upturned toothed projection, the internal border of which is also finely serrate. The aedoeagus is simple.

Records:—Colombia: Muzo. Peru, Huancabamba. Bolivia: Rio Sango.

Eudamus undulatus Hewitson (Fig. 19)

1867. *Eudamus undulatus* Hewitson, Desc. Hesp., p. 4 (locality ?)

1872. *Thymele sumichrasti* Scudder, Rep. Peabody Acad. Sci., iv, p. 69. (Tehuantepec).

1875. *Eudamus undulatus* Hewitson, Exot. Butt., v, text and Plate Eudamus, 2, fig. 16.

1880. *Goniurus nicasius* Plotz, Bull. Soc. Nat. Moscow, lv, p. 4 (Brazil).

1890. *Eudamus undulatus* Mabille and Vuillot, Nov. Lep., p. 13, Plate 2, figs. 4, 5 (Colombia).

1893. *Eudamus undulatus* Godman and Salvin, Biol. Cent.-Amer., Rhop., ii, p. 286, Plate 75, fig. 30 (♂ genitalia).

1921. *Eudamus undulatus* Draudt, Seitz's Macrolep., v, p. 856, Plate 160, a, b.

Godman first placed *sumichrasti* under *eurycles* Latrielle but after examining the type placed it as a synonym of *undulatus*. He also considered *nicasius* as synonymous, which is confirmed by Draudt.

This insect is provided with a tuft of hairs on the secondaries above on the internal margin, similar to that of *stylites*. In *undulatus* it is of the same brown color of the wing. The short stout aedoeagus carries numerous floating spines.

Records:—Paraguay: Villa Rica and Sapucay (Jorgensen). Brazil: Chapada and Corumba (Smith). Dutch Guiana: Paramaribo (Mayo). Colombia: Flores (Viereck); Muzo. Panama: Colon (Williams). Honduras: San Pedro Sula (Leinhart). Guatemala: Quirigua. Mexico: Vera Cruz (Williams); Colima; Mazatlan; Alta Mina.

Eudamus stylites Herrich-Schaeffer (Fig. 18)

1869. *Eudamus stylites* Herrich-Schaeffer, Corres. Blat. Regensburg, xxiii, p. 171 (locality?).

1890. *Eudamus stylites* Mabille and Vuillot, Nov. Lep., p. 11, Plate 2, figs. 2, 3 (Colombia).

1921. *Eudamus stylites* Draudt, Seitz's Macrolep., v, p. 854, Plate 160, c.

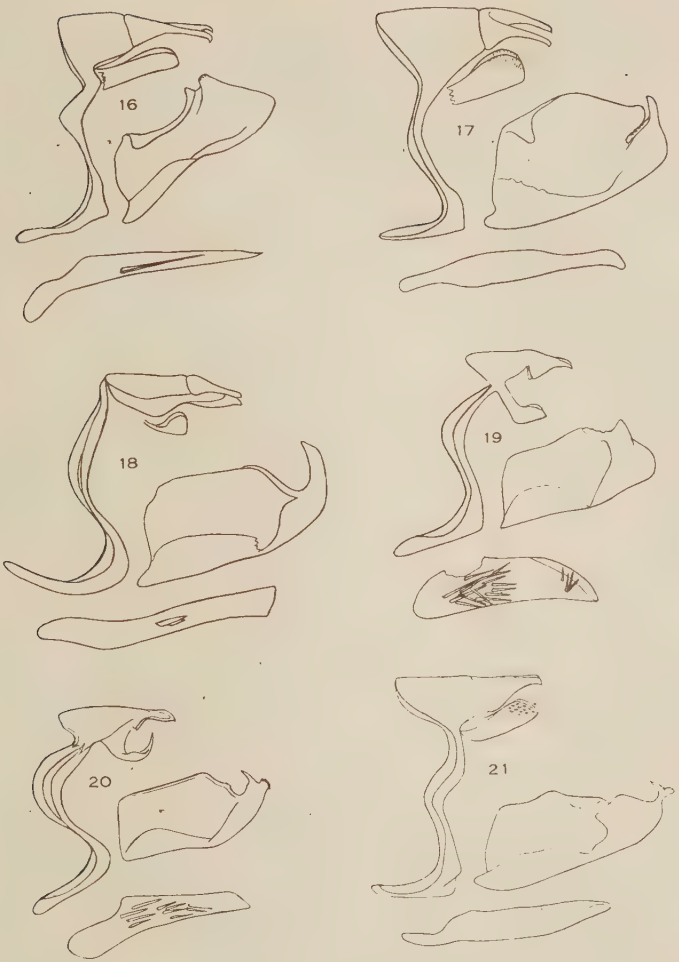

Fig. 16. *Eudamus chalco* Hubner, Muzo, Colombia. 17. *Eudamus harpagus* Felder, East Colombia. 18. *Eudamus stylites* Herrich-Schaeffer Potaro, British Guiana. 19. *Eudamus undulatus* Hewitson, Corumba, Matto Grosso, Brazil. 20. *Eudamus orion* Cramer, Chapada Matto Grosso, Brazil. 21. *Chioides catillus* Cramer, Canal Zone, Panama.

There is a tuft on the lower wing above the inner margin. This is mentioned by Godman and Salvin who state: "The Chiriqui specimen has this tuft brown, like the rest of the upper surface of the wings, as in *E. undulatus*. Others have it tawny."

In our specimen from Potaro, British Guiana, this tuft is lighter in color than the brown ground but I would hardly call it tawny. The uncus ends in a beak split only at its terminus. The valve has a strong upturned, terminal projection. The aedoeagus is simple and slender carrying only one branched spine.

Eudamus orion (Cramer) (Fig. 20)

1779. *Papilio orion* Cramer, Pap. Exot., II, p. 92, Plate 155, figs. A, B. (Surinam).
1845. *Hesperia orion* Lucas, Lep. Exot., Ed. 2, Plate 80, fig. 2.
1921. *Eudamus orion* Draudt, Seitz's Macrolep., V, p. 856, Plate 161, b.

The uncus ends in a single beak not split and the scaphium is slender, curved upwards. The valve has a peculiar terminus with an incurved strong hook. The aedoeagus carries numerous stout spines. These characters show that *orion* is not at all closely related to the somewhat similar *doryssus* group.

Records:—Brazil: Chapada (Smith); Amazons.

Codatractus alcaeus (Hewitson)

1867. *Eudamus alcaeus* Hewitson, Desc. Hesp., p. 3 (Nicaragua).
1872. *Thymele montezuma* Scudder, Rep. Peabody Acad. Sci., IV, p. 70 (Tehuantepec, Mexico).
1875. *Eudamus alcaeus* Hewitson, Exot. Butt., V, Plate Eudamus 2, fig. 9.
1893. *Eudamus alcaeus* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 281, Plate 75, fig. 12 (♂ genitalia).
1921. *Eudamus alcaeus* Draudt, Seitz's Macrolep., V, p. 854, Plate 160, c.
1922. *Eudamus alcaeus* Skinner and Williams, Trans. Amer. Ent. Soc. XLVIII, p. 118, fig. 16 (♂ genitalia).

Montezuma was placed under *alcaeus* by Godman. The description indicates that this is undoubtedly correct. To the records add Escuintla, Chiopas Mexico (White).

Codatractus aminias (Hewitson)

1867. *Eudamus aminias* Hewitson, Desc. Hesp., p. 4 (Minas Geraes, Brazil).
1875. *Eudamus aminias* Hewitson, Exot. Butt., V, Plate Eudamus 2, fig. 14.
1921. *Eudamus aminias* Draudt, Seitz's Macrolep., V, p. 854, Plate 160, c.

Record:—Paraguay, Villa Rica (Jorgensen) 2 ♀ ♀.

Chioides catillus (Cramer) (Fig. 21)

1782. *Papilio catillus*, Cramer, Pap. Exot., III, p. 119, Plate 260, figs. F, G. (Surinam).
[1816?] *Telegonus tarchon* Hubner, Saml. Exot. Schmt., I, Plate 145.
1848. *Papilio longicauda* Sepp, Surinam Vlind., II, Plate 90.
1880. *Goniurus ixion* Plotz, Bull. Soc. Nat. Moscow, LV, p. 13.
1893. *Eudamus catillus* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 280, Plate 75, fig. 9 and fig. 10 (♂ genitalia).
1921. *Eudamus catillus* Draudt, Seitz's Macrolep., V, p. 854, Plate 160, a.

The Draudt figure of *tarchon* in the Seitz work (Plate 172, a) is not at all like Hubner's original figure and probably represents the Plotzian concept of the insect. I agree with Godman and Salvin, that *tarchon* is synonymous with *catillus*. The male genitalia are very close to those of *albofasciatus* Hewitson.

Records:—PARAGUAY: Sapucay and Villa Rica (Jorgensen). BRAZIL: Chapada and Corumba (Smith); Sao Paula (Pohl). BOLIVIA: Rio Sango. VENEZUELA: Porto Cabello. COLOMBIA: Muzo. DUTCH GUIANA: Paramaribo (Mayo). COSTA RICA: Limon (Williams); Cartago (Gillott).

Race **macromaculatus** new race

Specimens from Huigra, Ecuador (Rhoads) have the discal spots enlarged, the two central spots elongated so that the lower one reaches the extra discal spot. They are also yellow in color instead of hyaline. Type 1 ♂ and one ♂ paratype.

Chioides albofasciatus (Hewitson)

1867. *Eudamus albofasciatus* Hewitson, Desc. Hesp., p. 3 (Polochic Valley, Guatemala).
1875. *Eudamus albofasciatus* Hewitson, Exot. Butt., V, Plate Eudamus 2, fig. 15.
1893. *Eudamus albofasciatus* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 280, Plate 75, fig. 11 (♂ genitalia).
1921. *Eudamus albofasciatus* Draudt, Seitz's Macrolep., V, p. 855, Plate 160, d.
1922. *Eudamus* (*Chioides*) *albofasciatus* Skinner and Williams, Trans. Amer. Ent. Soc., XLVIII, p. 117, fig. 14 (♂ genitalia).

Records:—MEXICO: Vera Cruz (Williams); Colima; Octolan; Oxaca. HONDURAS: San Pedro Sula (Leinhart).

Chioides zilpa (Butler)

1872. *Goniurus zilpa* Butler, Lep. Exot., p. 109, Plate 40, fig. 2 (Costa Rica).
1893. *Eudamus zilpa* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 279, Plate 75, fig. 8 (♂ genitalia).
1921. *Chioides zilpa* Lindsey, Iowa Stud. Nat. Hist., IX, p. 26, Plate 1, fig. 5.
1922. *Eudamus (Chioides) zilpa* Skinner and Williams, Trans. Amer. Ent. Soc., XLVIII, p. 117, fig. 15 (♂ genitalia).

Records:—MEXICO: Escuintla, Chiopas (White); Colima. BRITISH HONDURAS: Corozal. PANAMA: Santiago de Veraguas (Davies); Chiriqui. COLOMBIA: Muzo.

Eudamus ganna (Moschler) (Plate III, fig. 5 and Fig. 22)

1878. *Thymele ganna* Moschler, Verz. Zool. Bot. Ges. Wien., XXVIII, p. 204. (Venezuela).
1891. *Goniurus ganna* Mabille and Vuillot, Nov. Lep., p. 33, Plate 4, fig. 8. (♂ Itaituba).
1921. *Eudamus ganna* Draudt, Seitz's Macrolep., V, p. 856, Plate 161, c.

The Draudt figure is not a good one. The lower wing is too rounded and the tails too short, and the color too green. It was probably taken from the Plotz drawing mentioned by Mabille and Vuillet who state it differs from their example in that there are four apical dots in the Plotz insect while the Itaituba insect has but three. In our series from Chapada Brazil there are two distinct apical dashes, then somewhat removed outwardly a third dot, small and becoming obsolete, then still further removed a distinct square dot. I identify this species by the Mabille and Vuillot figure which agrees with Moschler's description very well.

Eudamus albistria (Plotz) (Plate III, fig. 6 and Fig. 23)

1880. *Goniurus albistria* Plotz, Bull. Soc. Nat. Moscow, LV, p. 19 (Rio).
1880. *Goniurus cholus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 19 (South America).
1907. *Goniurus leucodesma* Godman [Plotz ms.], Ann. Mag. Nat. Hist., XX, p. 133. Para. [Description unpublished?].
1921. *Eudamus cholus* Draudt, Seitz's Macrolep., V, p. 856, Plate, 161, c.

Albistria, being described just before *cholus*, has priority. In the original reference the Plotz drawings are numbered 47 and 48 respectively. In the Godman reference *leucodesma* carries the 47 number and *cholus* 48. It is likely that Plotz put the manuscript name *leucodesma* on the drawing, afterwards using the name *albistria* in the description, perhaps, because he discovered

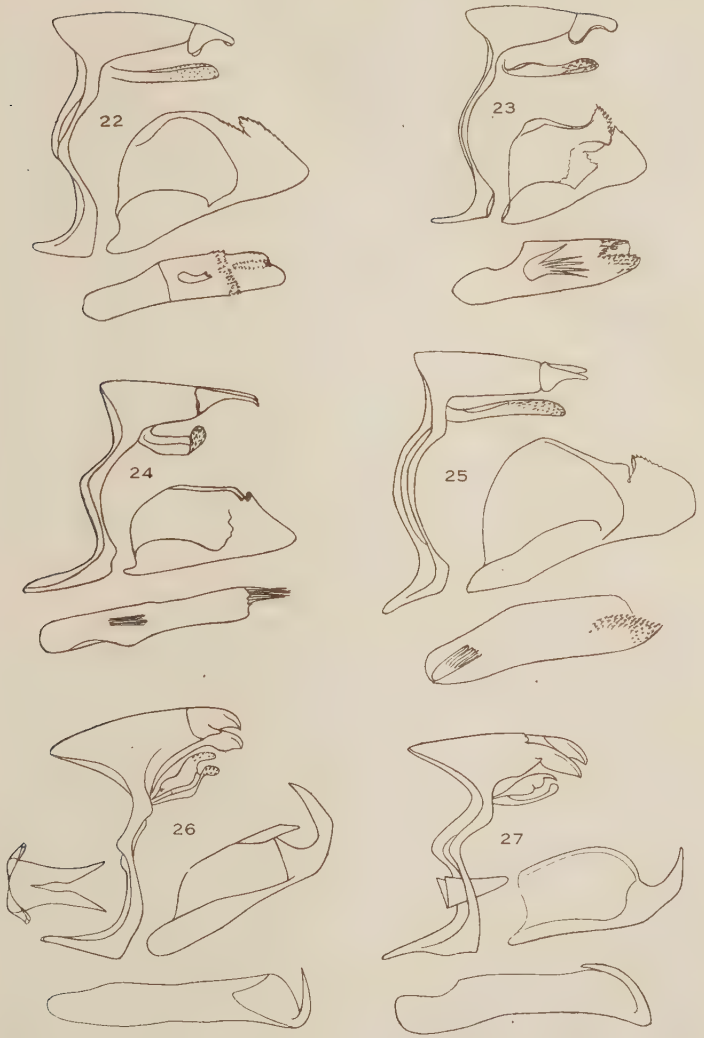

Fig. 22. *Eudamus ganna* Moschler, Chapada, Matto Grosso, Brazil. 23. *Eudamus albistria* Plotz, Chapada, Brazil. 24. *Eudamus metophis* Latrielle, Chapada, Brazil.

Fig. 25. *Eudamus camagura* Williams, Corumba, Matto Grosso, Brazil. 26. *Eudamus asine* Hewitson, Cartago, Costa Rica. 27. *Eudamus hirtius* Butler, Muzo, Colombia.

the former name had been used by Erichson for a Hesperid in 1848. Godman places *leucodesma* [= *albistria*] as synonymous with *cholus*, as does Draudt, and the differences, as tabulated by Plotz, are not distinct enough to warrant a separation. The Draudt figures of *cholus* are unsatisfactory. The first, showing the upper side, is correct as to the markings of the upper wing, but the tails of the lower wing are too long and spatulate. The second figure showing the under side will answer for the upper wing, but the lower seems to have the tails too short, and the band is too yellow.

Eudamus glaphyrus Mabille[3] has been placed under *cholus* [= *albistria*].

The discal band is stronger and more continuous, the extra discal spot is missing, and there are only two apical spots which are distinct dashes. Also the shape of both wings is different from those of *albistria*, the superiors being more pointed at the apex, and the inferiors being more rounded on the outer margin with the tails very much shorter. Therefore, this name should stand until there is more evidence to prove the synonymy.

Record:—Brazil: Chapada (Smith).

Eudamus metophis (Latrielle) (Plate III, fig. 7 and Fig. 24)

1823. *Hesperia metophis* Latrielle, Enc. Meth., IX, p. 792 (Brazil).
1836. *Eudamus metophis* Boisduval, Spe. Gen., I, Plate 15, fig. 5.
1893. *Eudamus metophis* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 276 (male genitalia like *chalco*).

I believe Godman and Salvin have correctly identified this species. They mention specimens from Chapada and Corumba, Matto Grosso (Smith), and our examples are from this locality and collector.

There is a considerable green shade to the wings above. The hyaline in the primaries is quite distinct; two dashes at the costa, a cellular spot constricted in the middle, followed by a large quadrate spot and a triangular one. The spot removed beyond the band tends to be elongated above towards the outer margin. There are four apical spots, two dashes, then further removed a dot, and still further another dot. The band of the under side of the secondaries is seen faintly indicated above. The fringes

[3] Le Natur., X, p. 109, fig. 4, 1888, Blumenau, Brazil.

are white and even on the lower portion of the outer margin of the primaries, also on the outer margin of the secondaries, reaching to and stopping at the tail.

Beneath, the conspicuous character is the band of the secondaries. This reaches from the costal margin to a point above the center of the tail, is parallel to the outer margin, and located about centrally on the wing. It is sharply defined within by a line darker than the brown ground color of the wing; is whitish gray with a somewhat lilac shade, and dissolves gradually towards the outer margin, into the ground color of the wing. The tails are long, about the length of the wing. The figure in Seitz[4] I believe must refer to some other species.

The male genitalia are only superficially like those of *chalco*, with which they are compared by Godman and Salvin. The projection from the uncus is deeply split, the scaphium, similar in shape to that of *chalco*, is, however, shagreened at its outer extremity. The valve is rather simple, recalling that of *proteus*. The aedoeagus carries a bundle of short floating spines within, and also at the extremity, there is a bunch of slender spines connected at their bases, where they seem to be attached by membrane to the aedoeagus.

Eudamus camagura new species (Plate III, fig. 8 and Fig. 25)

Associated with *metophis* from Chapada, Matto Grosso, Brazil, is an insect resembling *metophis*, but quite different genitalically. Above it is brown, with body and basal portion of wings of a greenish tint, caused by long, rather light green hairs. Fore wings more angulated at extremity (more rounded in *metophis*), hind wings with shorter tails, fringes gray, angulated especially on lower wing. Hayline spots, discal band of two dashes at costal margin, two quadrate spots constricted laterally, and a subtriangular spot. Four apical spots extend from the costal border towards the apex.

Below, it is light brown with a lilac shade, and hyaline spots of the upper wing repeated. In the lower wing the ground color ends abruptly in a line from the center of the costa to a point near the inner margin beyond the tail. This is followed by a whitish band outward, fusing into the brown ground color.

The male genitalia differ considerably from those of *metophis*. The uncus is long and the split projections short and stout. The

[4] Macrolep., V, plate 160, d. 1921.

scaphium is long and slender with the outer portion shagreened. The valve is rather rounded outwardly, the outer lobe provided with teeth internally. The aedoeagus is stout with the outer portion well shagreened, and it carries a stout bundle of short spines fused at their base.

Type 1 ♂, Chapada, Brazil.

Named for a Tupi tribe of Indians occupying the type locality in Matto Grosso.

Eudamus megaeles Mabille

1888. *Eudamus megaeles* Mabille, Le Natur., An. x, p. 99, fig. 4, (? locality).
1890. *Goniurus megacles* Mabille & Vuillot, Nov. Lep., ix, p. 26, Plate 4, fig. 1 (Santa Catharina, Brazil).

Record:—Brazil: Chapada, Matto Grosso (Smith) 1 ♀.

Eudamus asine Hewitson. (Fig. 26)

1867. *Eudamus asine* Hewitson, Desc. hesp., p. 5 (Nicaragua).
? 1869. *Eudamus caunus* Herrich-Schaeffer, Corres. Blat. Regensburg, xxiii, p. 170 (locality ?).
1872. *Thymele vitreus* Scudder, Rep. Peabody Acad. Sci., iv, p. 68, (Venezuela).
? 1891. *Eudamus asine* Mabille and Vuillot, Nov. Lep., p. 27, Plate 4, fig. 2 (♀).
? 1922. *Eudamus asine* Draudt, Seitz's Macrolep., v, p. 857, Plate 161, d.

Our specimens, males, correspond with the description and the Godman and Salvin conception of the species, in that they have the distinct black spots near the inner border on the primaries above. The Mabille and Vuillot figure of *asine* Hew. (*caunus* H-S) is a female, and it is without black spots, and the band above and below. It may not represent the ♀ of this species.

Godman saw the type of *vireus* Scudder and has identified it as *asine*. The Draudt figure is still different, the black spots seeming to be replaced by whitish ones.

The uncus ends in two beak-like projections with additional outer lobes at their base; the scaphium is composed of two strong lobular arms. The valve ends in a strong upturned hook. The aedoeagus is remarkable in that it ends in a strong hook, upturned. Its support or juxta is but a slight ring, with two long pointed arms below.

Records:—Costa Rica, Cartago (Gillott); Colombia, Muzo.

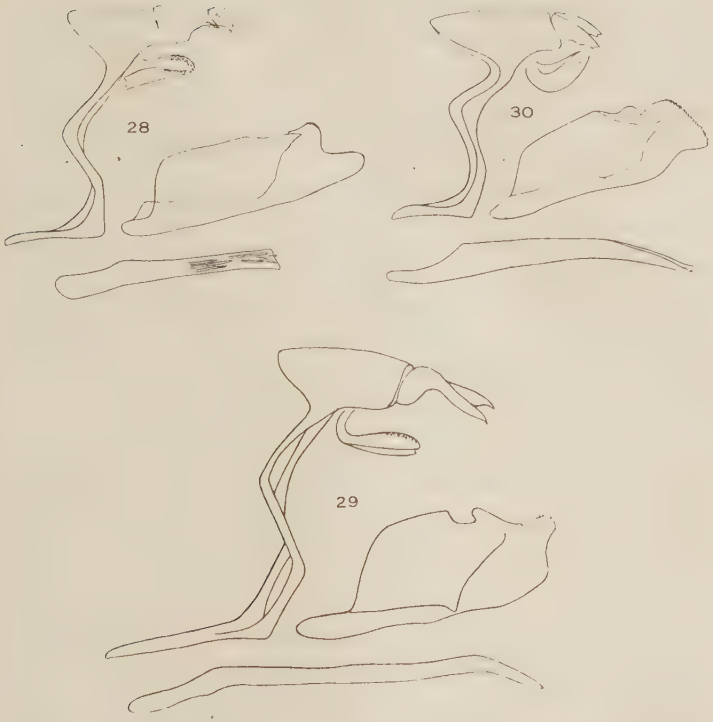

Fig. 28. *Eudamus ceculus* Herrich-Schaeffer, Villa Rica, Paraguay. 29. *Eudamus octomaculata* Sepp, Corumba, Matto Grosso, Brazil. 30. *Eudamus minvanes*, Williams, Entre Rios, Argentine.

Eudamus hirtius (Butler) (Fig. 27)

1870. *Goniurus hirtius* Butler, Trans. Ent. Soc. London, IV, p. 491 (Venezuela).
1890. *Goniurus hirtius* Butler, Lep. Exot., p. 64, Plate 24, fig. 3.
1922. *Eudamus hirtius* Draudt, Seitz's Macrolep., V, p. 857, Plate 161, e.

A Hesperid I identify as *hirtius* from Muzo, Colombia, is genitalically very close to *asine*. The tegumen is practically the same; the valve has the projecting hook, but the upper margin is rounded outwardly instead of being pointed. The aedoeagus has the characteristic hook but the juxta is not so pointed as it is in *asine*.

Eudamus ceculus Herrich-Schaeffer (Fig. 28)

1869. *Eudamus ceculus* Herrich-Schaeffer, Corres. Blat. Regensburg, XXIII, p. 170 (Trop. Amer.).

1870. *Goniurus lindora* Butler, Trans. Ent. Soc. London, IV, p. 491 (locality?)

1890. *Eudamus lindora* Butler, Lep. Exot., p. 64, Plate 25, fig. 1.

1893. *Eudamus auginus* Godman and Salvin [? not Hewitson], Biol. Cent.-Amer., Rhop., II, p. 283, Plate 75, fig. 26 (♂ genitalia).

1921. *Eudamus ceculus* Draudt, Seitz's Macrolep., V, p. 857, Plate 161, d.

I use the name *ceculus* here, instead of *auginus* Hewitson. Godman and Salvin who examined the presumably authentic type of *ceculus*, place it under their conception of *auginus*, which they seem to have misidentified. *Auginus* Hewitson, by description and subsequent figure, has three apical dots and three discal spots, instead of four as stated by Godman and Salvin. All of our series have four distinct apical dashes in line, and three discal spots with a fourth smaller one below, these appearing sometimes in the males and always in the females. Our species also agrees with Godman and Salvin's *auginus* in the male genitalia, and they mention specimens from Chapada, Matto Grosso (Smith); we have some of these in our series.

Lindora, with its four apical dashes and three large and one smaller discal spot, I take to be *ceculus*.

Auginulus Godman and Salvin, I take to be either *auginus* Hewitson or a form in which the green shading of the typical *auginus* is absent.[5]

[5] **Eudamus auginus** Hewitson

1867. *Eudamus auginus* Hewitson, Desc. Hesp., p. 6 (Amazon).

1869. *Eudamus flammula* Herrich-Schaeffer, Corres. Blat. Regensburg, XXIII, p. 170 (Trop. Amer.).

1875. *Eudamus auginus* Hewitson, Exot. But., V, text and Plate Eudamus 2, fig. 13.

1891. *Goniurus auginus* Mabille and Vuillot, Nov. Lep., p. 31, Plate 4, fig. 6, [presumably type of flammula Herrich-Schaeffer].

? 1893. *Eudamus auginulus* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 284, Plate 75, figs. 20, 21 (♂ genitalia) (Paso de San Juan, Mexico; Zapate, Guatemala).

1921. *Eudamus auginus* Draudt, and *auginulus* Draudt, Seitz's Macrolep., V, p. 857, Plate 161, d.

The uncus terminates in a split beak, at the beginning of which there are a pair of external, short projections. The aedoeagus carries a number of rather long tubular, floating spines.

Records:—PARAGUAY: Villa Rica (Jorgensen). BRAZIL: Chapada (Smith). BOLIVIA: Coroico; Rio Sango.

Eudamus octomaculata (Sepp) (Fig. 29)

1848. *Hesperia octomaculata* Sepp, Surinam Vlind., II, Plate 58. (Surinam).
1888. *Eudamus calenus* Mabille, Le Natur, An. x., p. 99, fig. 3 (Guatemala).
1893. *Eudamus octomaculatus* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 248, Plate 75, fig. 23 (♂ genitalia).
1922. *Eudamus octomaculata* Draudt, Seitz's Macrolep., V, p. 857, Plate 161, d. [as *maculata*].

Mabille himself places *calenus* as a synonym of *octomaculata*. The projections from the uncus, deeply split, are rather almond shaped and end in sharp points, the scaphium is shagreened externally, the saccus is comparatively long. The valve is finely denticulated on the external dorsal rounded edge and there is a deep round excavation at the middle of the dorsal border. The aedoeagus is simple, long and slender.

Records:—PARAGUAY: Villa Rica (Jorgensen). BRAZIL: Chapada and Corumba (Smith). BOLIVIA: Coroico. COLOMBIA: Muzo.

Eudamus alciphron Godman and Salvin

1893. *Eudamus alciphron* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 285, Plate 75, figs. 24, 25 (♀ Rincon in Guerro, Mexico).
1922. *Eudamus alciphron* Draudt, Seitz's Macrolep., V, p. 857, Plate 161, d.

Record:—COSTA RICA: Cartago (Gillott) 1 ♀.

Eudamus minvanes new species (Plate III, fig. 1 ♂, 2 ♀ and Fig. 30)

Male: wings above brown, a costal fold and also a prominent sexual tuft on the costal border of the lower wing, emanating from a point close to the base. Upper wing with six hyaline spots, three apical dashes parallel with each other, and three central spots, one in cell, heart-shaped, below it a round spot and between and removed slightly outwardly, a dot. Fringes, upper wing brown, lower wing outer margin to tail, white. Wings below lighter brown, the upper wing with inner margin lighter

and just above, centrally located, a strong, rectangular, deep brown spot. Hyaline spots repeated. The lower wing has two very faintly darker bands parallel to the outer margin. Expanse, upper wing, body to tip 17 mm.; lower wing to outer margin 10 mm.; to tail 13 mm., tail 7 mm.

Female: similar to male, larger, hyaline spots somewhat larger and with some darker spots on both wings, and the bands of the lower wings indicated above. Below them are some darker spots on the upper wing, just beyond and below the hyaline group, but the dark brown rectangular spot, so prominent in the male is not present. On the lower wing the inner band is represented by three darker spots, the outer band is prominent, and lower outer margin and tail dark brown.

Described from 1 ♂ type from Chapada, Matto Grasso, Brazil, and 1 ♀ allotype from Entre Rios, Argentine. Named for a tribe of Indians occupying this region.

This insect is remarkable in that the male carries three sexual characters, the fold, the tuft, and the inner marginal patch on the under side of the upper wing.

The uncus ends in a short pair of beaks; the scaphium is short and stout with very fine shagreenations. The valve ends in a stout truncate lobe, finely serrated outwardly. The aedoeagus is simple, ending in two slender prongs.

Goniurus simplicius Stoll

1790. *Goniurus simplicius* Stoll, Sup. Cramer, p. 171, Plate 39, figs. 6, 6 E (Surinam).

[1816?]. *Urbanus fortis dorantes* Hubner, Saml. Exot. Schmet., I, Plate 154, figs. 2, 4 [not *dorantes* Stoll] [Figs. 1, 3 are *eurycles* Latrielle].

1880. *Goniurus pilatus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 3 (Brazil).

1880. *Goniurus procne* Plotz, Bull. Soc. Nat. Moscow, LV, p. 3 (Brazil).

1893. *Eudamus simplicius* Godman and Salvin, Biol. Cent.-Amer., Rhop., II, p. 270, Plate 75, fig. 1 (♂ genitalia).

1922. *Eudamus simplicius* Skinner and Williams, Trans. Amer. Ent. Soc., XLVIII, p. 116, fig. 12 (♂ genitalia).

Pilatus and *procne* have been placed in the synonymy by both Godman and Draudt.

Records:—Mexico: Vera Cruz (Williams); Colima. Guatemala: Puerto Barrios. Honduras: San Pedro Sula (Leinhart). Costa Rica: Cartago (Gillott). Panama: Santiago de Veraguas (Davies); Colon and Gatun, Canal Zone, and David (Harrower). Colombia: Cauca (Bonis); Muzo. Venezuela: Porto Cabello (Klages). Bolivia: Coroico; Rio Sango; La Piedrita (Brown). British Guiana: Potaro; Bartica. French Guiana. Ecuador: Huigra (Rhoads). Brazil: Chapada, Matto Grosso (Smith); Santa Catharina (Pohl). Paraguay: Sapucay and Villa Rica (Jorgensen).

Goniurus eurycles (Latrielle)

[1816?]. *Urbanus fortis dorantes* Hubner, Saml. Exot. Schmet., I, Plate. 154, figs. 2, 4 [not *dorantes* Stoll], [Figs. 1, 3 are *simplicius* Stoll].

1823. *Eudamus eurycles* Latrielle, Enc. Meth., IX, p. 730 (Brazil).

1880. *Goniurus zagorus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 3 (Allagra).

1880. *Goniurus zalanthus* Plotz, Bull. Soc. Nat. Moscow, LV, p. 3 (Allagra).

1891. *Goniurus latipennis* Mabille and Vuillot, Nov. Lep., V, p. 36, Plate 5, fig. 1 (Cayenne).

1922. *Eudamus eurycles* Skinner and Williams, Trans. Amer. Ent. Soc., XLVIII, p. 116, fig. 13 (♂ genitalia).

Zagorus is identified by Godman as "probably a small *eurycles*," and *zalanthus* as *eurycles*. Draudt places them both in synonymy. *Latipennis* seems to be a rather large *eurycles*.

Records:—Mexico: Texola; Vera Cruz; Mazatlan. Guatemala: Puerto Barrios. Honduras: San Pedro Sula (Leinhart). Nicaragua: Eden (Huber). Costa Rica: Bocas del Toro (Williams); Rio Surubres (Calvert); Cartago (Gillott); Carello. Panama: Santiago de Veraguas (Davies); Colon and Gatun, Canal Zone (Harrower); David (Harrower). Colombia: Sierra san Lorenze, Magdalena (Rehn); Cauca (Bonis); Vista Nieve (Viereck); Muzo. Venezuela: Buelta Trieste (Brown). British Guiana: Between Essequibo and Demerara Rivers (Fox); Bartica. Dutch Guiana: Paramaribo (Mayo). Trinidad Island. Ecuador: Huigra (Rhoads). Brazil: Chapada, Matto Grosso (Smith); Sao Paulo and Santa Catharina (Pohl). Paraguay: Sapucay and Villa Rica (Jorgensen). Bolivia: Coroico; Rio Sango. Peru: Madre de Dios.

EXPLANATION OF PLATES

Plate II.

Fig. 1. *Eudamus dorantes* race *rauterbergi* Skinner, ♂, Baboquivari Mountain, Pima County, Arizona.

Fig. 2. *Eudamus dorantes* race *calafia*, Williams, type, ♂, Lower California.

Fig. 3.—*Eudamus dorantes* race *parvus* Skinner, type, ♂, St. Pierre, Martinique.

Fig. 4.—*Eudamus dorantes* race *gallapagensis* F. X. Williams paratype, ♂, Chatham Island, Gallapagos Is.

Fig. 5.—*Eudamus dorantes* race *retractus* Plotz, ♀, British Guiana.

Fig. 6.—*Eudamus motilones* Williams, type, ♂, Venezuela.

Fig. 7.—*Eudamus marmorosa* Herrich-Schaeffer, ♂, Cuba.

Fig. 8.—*Eudamus myrto* Mabille, ♂, Haiti.

Plate III.

Fig. 1.—*Eudamus minvanes* Williams, type, ♂, Entre Rios, Argentine.

Fig. 2.—*Eudamus minvanes* Williams, allotype, ♀, Chapada, Matto Grosso, Brazil.

Fig. 3.—*Eudamus huancavillcas* Williams, type, ♂, Huigra, Ecuador.

Fig. 4.—*Eudamus acawoios* Williams, type, ♂, Potaro, British Guiana.

Fig. 5.—*Eudamus ganna* Moschler, ♂, Chapada, Brazil.

Fig. 6.—*Eudamus albistria* Plotz, ♂, Chapada, Brazil.

Fig. 7.—*Eudamus metophis* Latrielle, ♀, Corumba, Matto Grosso, Brazil.

Fig. 8.—*Eudamus camagura* Williams, type, ♂, Chapada, Brazil.

WILLIAMS—NEOTROPICAL HESPERIOIDEA

WILLIAMS—NEOTROPICAL HESPERIOIDEA

THREE NEW SPECIES OF CICADELLIDAE PREVIOUSLY CONFUSED WITH RELATED SPECIES (HOMOPTERA)

BY D. M. DELONG

Department of Entomology, Ohio State University.

Deltocephalus lawsoni new species

In general appearance resembling a *Thamnotettix* of the *fitchii* group but apparently more closely related to *Deltocephalus*. Length, 3.5 to 4 mm.

Vertex rather bluntly angled, slightly longer on middle than width between eyes. Pronotum twice wider than long, side margins very short. Elytra longer than abdomen, venation typically *Deltacephaloid*.

Color buff to straw yellow, vertex with a pair of triangular spots just back of apex, another pair, one next each ocellus and just above margin, a minute pair just back of ocelli against eyes and a large quadrate pair on anterior portion of disc, brown. Pronotum with six longitudinal orange stripes, the central pair apparently arising just back of discal spots on vertex and extending across basal angles of scutellum. A pair of inwardly curved parenthesis spots on base of disc of scutellum, brown, Elytra with veins pale, conspicuously, sometimes rather heavily infuscated with brown. Face infuscated above with median line and traces of about six pairs of pale arcs.

Genitalia: Female last ventral segment rather long, side margins short, then concavely rounded to trilobate posterior margin. Underlying membrane prominent where last ventral segment is cut away either side. Male valve three times as long as plates, convexly rounded. Plates as long as combined width at base, gradually tapered to acutely pointed apices. Plates equaling pygofers in length.

Described from a female and two male specimens from Cherokee Co., Kansas, and one female specimen from Vicksburg, Miss., collected July 19, 1921, by D. W. Grimes. These speci-

mens, especially those from Kansas, have been at hand, for several years. Two of the type series are in the collection of Prof. Herbert Osborn and two are in the author's collection.

Type: Female; Cherokee County, Kansas; in author's collection.

I take pleasure in naming this species in honor of Dr. P. B. Lawson who has accomplished so much in his work with the leafhoppers of this region.

Phlepsius bipartitus new species

Resembling *carolinus* under which name it has been designated, but differing from it by the less produced lateral angles of the female segment and the unique internal genitalia of the male. Length, 6 to 6.5 mm.

Vertex produced at middle, angled with front, more than twice as long between eyes as length at middle. Pronotum almost twice as long as vertex.

Color: Dull white to gray with brownish reticulations and irrorations, without specific dark markings.

Genitalia: Female last ventral segment three times the length of preceding, central half elevated, slightly produced, margin embrowned and notched at apex. Lateral angles produced and well rounded, separated from elevated portion by rather deep rounding emarginations. Male valve broadly triangular, about the length of preceding segment. Plates rather long, gradually narrowed to blunt rounded apices.

In the case of the males of *carolinus* the oedagus terminates in a heavy spine which curves ventrally and is visible from the external view. In the case of *bipartitus* the oedagus is broad and turns abruptly dorsally and again forward at the tip. The ventral curved portions are also broadened. In addition to this, two long curved processes arise anteriorly and extend through the opening between the pygofers. A good external character for the male is the fact that a spine occurs dorsally on the pygofers in *carolinus* while in *bipartitus* it is located on the ventral portion. The styles in *carolinus* are considerably larger than in *bipartitus*. The females can easily be distinguished by the shorter lateral angles in the latter species.

Described from two females and two males collected at Paradise Key, Florida, April 4 to 10, 1921, swept from grasses, and one female taken at Orlando, Florida, April 29, 1921, all collected by the author. These specimens marked "*carolinus*"? were submitted to Osborn and Lathrop during their monographic study of this group but no disposition was made of this species at that time. After a return of this material an examination showed them to be distinct species.

Type: Male; Paradise Key, Florida, April 4, 1921, in author's collection.

Thamnotettix arundineus new species

Coloration and general appearance of *shermani* but more narrowed, less robust, vertex more angled and with distinct genitalia. Length, 4.5 to 5 mm.

Vertex bluntly angled, almost one-fourth wider between eyes than length at middle. Elytra with two cross nervures as in the other species of this group.

Color: Vertex with a pale, creamy band on margin between eyes, frequently margined with brown below and a broken brownish line above, composed of four irregular, triangular spots. Behind these two broad orange longitudinal bands arise and extend across pronotum to basal angles of scutellum. There are also two narrower bands on each side of the pronotum making six in all. Elytra smoky subhyaline tinged with orange in some specimens. Veins whitish. Face yellow tinged with orange.

Genitalia: Female last ventral segment produced from either side to form a pair of broadly rounding lobes between which the posterior margin is broadly roundingly excavated more than half way to the base. Male valve broad, triangular, plates long and narrow, almost three times as long as valve and gradually tapering to rather sharp apices.

Described from a large series of specimens collected by the writer at Clarksville, Tennessee, from cane, *Arundinaria tecta*, during July and September 1915 and 1917. This species can easily be separated from *shermani* by the size and genital characters.

Type: Female; Clarksville, Tennsssee, July 5, 1915; in author's collection.

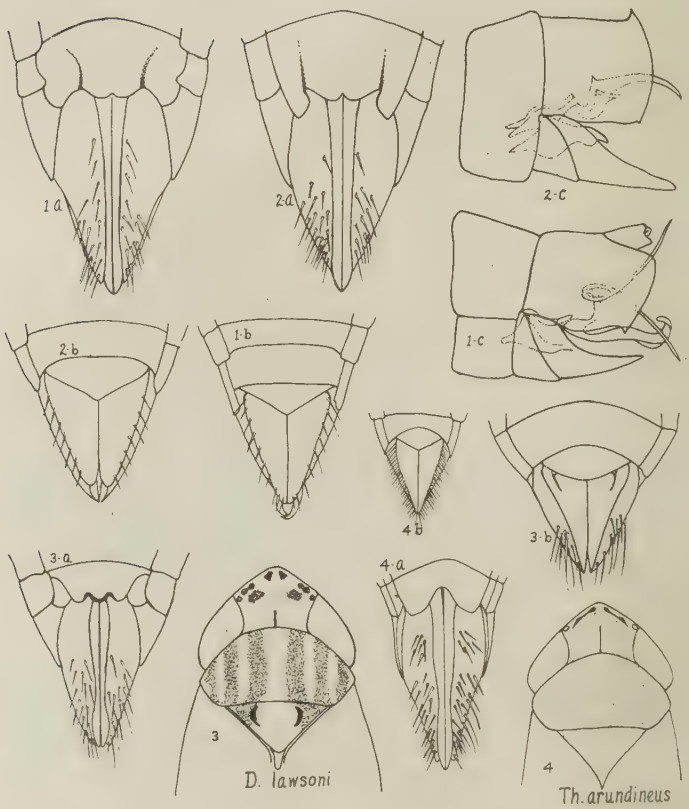

Fig. 1. *Phlepsius bipartitus* DeL. 1a, female genitalia; 1b, male genitalia; 1c, internal male genitalia, lateral view. Fig. 2. *Phlepsius carolinus* Lath. 2a, female genitalia; 2b, male genitalia; 2c, internal male genitalia, lateral view. Fig. 3. *Deltocephalus lawsoni* DeL., head; 3a, female genitalia; 3b, male genitalia. Fig. 4. *Thamnotettix arundineus* DeL., head; 4a, female genitalia; 4b, male genitalia.

THE GENUS LONATURA OSBORN AND BALL (HOMOPTERA, CICADELLIDAE)

BY D. M. DELONG

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The genus *Lonatura* contains only a small group of species, all of which are North American according to known records and our knowledge of world species. To date only nine species have been placed in this genus by North American workers on Homoptera and some of these are probably members of other genera. During a study of these species and those of allied genera the writer has placed in other genera three species now known as members of *Lonatura* and has described one new species from material in the collection of Dr. E. D. Ball, and another from specimens in the Osborn, Ball and DeLong collections.

The genus was established in 1898 by Osborn and Ball,[1] and *Lonatura catalina* O. & B. was cited as the type species. *Megalopa* was also described but the generic standing was questioned by the authors at that time. In describing these species *D. minuta* Van Duzee was mentioned although previously described as a species of *Deltocephalus*. It has been known as a *Lonatura* since this citation. In 1899 *salsura* was described by Ball and in 1900 two more species, *noctivaga* and *nebulosa*, were added by the same author. *Bicolor* was described by Van Duzee in 1909 from Florida and *notata* by Osborn from the same state in 1922. According to the original description of the genus it is thus characterized:

"Head conical, slightly obtuse, more than three times wider across eyes than length on the middle of vertex, curvature of posterior margin about one-half that of anterior. Front two and one-half times wider than on clypeus, width and length about equal, clypeus broad, parallel-margined, thorax broad distinctly angled within, genae rather narrow, roundingly angled, extending very narrowly below lorae to clypeus. Pro-

[1] Proc. Davenport Acad. Sci., VII, p. 83, 1898.

notum scarcely as long as vertex, nearly truncate behind, humeral margin straight, nearly meeting the eye, which curves around the lateral margin. Abdomen normal in form, ovipositor very long in female, extending beyond the pygofers, occurs in two forms; macropterous with fully developed elytra and wings reaching well beyond the abdomen. Elytra long and narrow, the costal margin nearly straight, appendix large, venation obscure, veins on clavus nearly parallel, united by a cross-nervure, the two branches of the outer sector again uniting after the forking of the inner branch and then forming only two anteapical cells, of which the outer is the larger, inner three apical cells greatly elongate, as long as the anteapicals, outer two on the costal margin smaller; in this form the scutellum is very large and strong. Brachypterous form in which the elytra only cover the second abdominal segment and the wings are rudimentary, the elytra are twice wider than long, broadest at the apex, venation obscure, the inner branch of the outer sector forking again before the apex, forming a single closed cell. In this form the pronotum covers the base of the elytra and most of the scutellum."

Although the genus description as originally stated probably included everything known at that time, it will not include certain species described since which undoubtedly should be placed in the same group. A previous paper by the writer[2] has discussed the characters of the first pair of wings as found in the species of this and related genera. In view of these more constant characters where most others are quite variable, probably the emphasis should be placed upon the wing character as given in the original description by Osborn and Ball. The genitalia are not of a constant type throughout the group, and the head in different species is quite different. The vertex is not flattened but usually is gently sloping to the front. In the subgenus *Deltocephalus* to which it is closely related the vertex is more strongly sloping to the front, the slope increasing toward the margin of the vertex. The size of species and the general body form is also variable in these species of *Lonatura*.

Within the genus the species could be divided into three separate groups. In one of these might be placed *L. catalina* a very

[2] Ohio Jour. Sci. Vol. xxvi No. 1. January, 1926.

minute species with a conical head character. In another group one might place *L. noctivaga*, *salsura* and *melina*. These three species are large in size and are more closely related to *Athysanella* than the previous species mentioned. In the third group might be placed the long headed forms *L. bicolor*, *notata* and *balli*. Although sufficient evidence is not available to place these in a separate genus, they differ from the preceding species in having a slightly different wing condition and minor body differences. These three southern species are apparently more closely related to each other than to the western species.

The other species previously included as members of the genus *Lonatura* are apparently more closely related to species of *Deltocephalus* and are placed at this time with their suggested relatives. *D. minuta* has already been cited in the subgenus *Deltocephalus* by the writer.[3] A study of *D. megalopus* has revealed its close relationship to *D. pulicarius*, *castoreus* and related species. The type of wing, genitalia, body, head, and color characters would indicate this relationship. *D. nebulosus* seems to be related to *obtectus* because of its bluntly angled head which is strongly sloping to the front, the similar genitalia in both sexes, the type of elytra and the color pattern.

The types of all the western species are contained in the private collection of Dr. E. D. Ball, who has very kindly loaned his material during this study. The writer is greatly indebted to Dr. Ball since it would have been impossible to make the accompanying figures and key without these specimens. The present arrangement is an attempt to form a working basis for this genus.

Key to Species of Lonatura.

1. Vertex rather sharply angled, longer on middle than basal width between eyes. Species known only from Florida or Gulf Coast 2

   Vertex more bluntly angled, length at middle not exceeding width between eyes, usually wider between eyes than length at middle 4

[3] Ohio State Univ. Bull. Univ. Studies, II, No. 13, p. 88, 1926.

2 Vertex, at least anterior portion between ocelli, black, elytra yellowish, unmarked ..... *bicolor*

Vertex duty yellow, frequently with black markings, elytra marked with black spots usually in pairs..... 3

3 Length not exceeding 3 mm., vertex almost one-fourth longer than basal width between eyes, two broken longitudinal stripes extending from apex of vertex to base of scutellum. *balli*

Length 3.5 mm. or more, vertex only slightly longer than basal width, vertex mottled but not striped.....*notata*

4 Size small, less than 3 mm., color varying from pale yellow to dark brown, without definite markings.....*Catalina*

Size larger, more than 3 mm. in length, some species with markings on vertex 5

5 Female segment with central lobe scarcely produced or sunken and rather broadly rounded, usually with definite markings on vertex..... 6

Female segment with a deep notch either side of a produced center, both narrowly rounded at apex, without definite color markings on vertex.....*salsura*.

6. Vertex with four distinct black spots just above margin, female central lobe slightly produced and bluntly pointed *noctivaga*

Markings on vertex usually faint, female central lobe sunken and broadly rounded ..... *melina*

Lonatura bicolor Van Duzee (Plate IV, figs., 2, 2a, 2b)

Lonatura bicolor Van Duzee, Bul. Buf. Soc. Nat. Sci., xi, p. 221, 1909.

Easily distinguished from the other species of the genus by the black vertex, bright yellow elytra and usually black abdomen. Length 2.5 to 3 mm.

Vertex strongly produced and rather sharply angled, about one-fourth longer on middle than width between eyes. Pronotum one-third shorter than vertex and more than twice as wide as long. Elytra covering only two basal segments. No macropterous forms have been observed.

Color: Black, shining, traces of pale arcs on face; vertex with ocelli, a spot at apex, three round spots back of anterior margin, posterior margin and a pair of oblique dashes extending toward ocelli, yellow. Pronotum, scutellum, and elytra, bright yellow.

Genitalia: Female last ventral segment a little longer than preceding. Posterior margin with a rather deep notch on each side of a central rounded lobe occupying the central two-thirds of the segment. Notched in such a way as to give an impression of side plates of an underlying membrane. Male valve apparently concealed. Plates narrow, triangular, elongate, concavely narrowed toward apices.

Known only from Florida where it occurs abundantly on the small grasses of the prairies and pine savannahs. Taken abundantly on the prairie at La Belle, Florida, from an association of *Lachnocaulon anceps* and other minor species of plants.

Lonatura bicolor var. **melleus** DeLong

Lonatura bicolor var. *melleus* DeLong, Jour. N. Y. Ent. Soc., xxxii, p. 64, 1924.

Differing from *bicolor* only in coloration. The most marked difference is the yellow coloration in place of the black shining abdomen and venter. On the vertex only a small amount of black mottling is left on the anterior portion. The last dorsal segment usually black. Venter yellow or light brown with dark markings.

As far as records go it occurs over the same area as typical *bicolor*.

Lonatura balli new species (Plate IV, figs., 3, 3a, 3b.)

Resembling *notata* in general appearance but smaller, with distinct coloration and genitalia. Length 2.75 to 3 mm.

Vertex rather sharply produced, almost one-fourth longer on middle than basal width between eyes and one-fourth longer than pronotum which is more than twice as broad as long. Elytra short as in *notata*. Abdomen exposed dorsally. A broadly rounded segment covering basal dorsal portion of pygofers in male.

Color: Brownish yellow; two broken longitudinal lines arising just back of apex of vertex and extending to basal angles of scutellum where they end in a pair of black spots. Pronotum with two outer pairs of longitudinal stripes. Elytra with markings similar to *notata*. Always with the pair of spots on outer claval vein about its middle and usually with a pair on basal portion of inner anteapical cell. Abdomen with longitudinal rows of small darker spots.

Genitalia: Female last ventral segment with produced, broadly rounded lateral margins; posterior margin excavated either side of a short sunken median tooth which is exceeded in length by the lateral angles. Male valve not visible. Plates short and blunt, well rounded at apex. Half as long as last ventral segment and less than half as long as pygofers.

Described from a pair of specimens from Sanford, Florida, Sept. 10th and 30th, 1925, collected by Dr. E. D. Ball. Four male specimens from McComb, Wade and Pascagoula, Mississippi, Feb. 20 to March 3, in the collection of Prof. Herbert Osborn and a series of specimens from Ft. Myers, Cleveland, and La Belle, Florida, collected by the author during April, 1921.

Type: Male; Cleveland, Florida, April 26, 1921. Collection of the author.

As compared with *notata* it is smaller with a more sharply angled vertex and the two longitudinal strips are characteristic of this species. The female tooth is more sunken and the male plates are broader and more blunt at the tips. The dorsal segment covering the male pygofers is triangular in *notata* while in *balli* it is broadly rounded.

Lonatura notata Osborn (Plate IV, figs., 1, 1a, 1b)

Lonatura notata Osborn. Florida Ent., VI, No. 2, p. 18, 1922.

A pale brown or yellowish species marked with brown spots in pairs on the pronotum, scutellum and elytra. Length 3.5 to 3.75 mm.

Vertex produced and bluntly angled, a little longer on middle than width between eyes. Elytra in brachypterous forms covering only first two dorsal segments. In macropterous forms covering first seven abdominal segments.

Color: Yellow to pale brown; vertex mottled with darker brown, and in well marked specimens with three pairs of darker marks on the median portion. Four other pairs of dark spots are conspicuous, a proximal pair on anterior margin of pronotum, a pair in basal angles of scutellum, one on outer claval vein about its middle and one on basal portion of inner ante-apical cell of each wing. Dorsal portion of abdomen where exposed marked with pairs of dark brown spots.

Genitalia: Female last ventral segment as long as preceding. Posterior border slightly emarginate; a rather broad median produced tooth which is slightly notched at apex. Male valve very small, only about one-fourth as wide as last ventral segment and slightly produced beyond it. Plates only one-third as long as last ventral segment and together about half as wide, triangular with blunt tips.

Reported only from Florida and Mississippi. It is probably distributed along the Gulf Coast. In Florida it occurs in great abundance on the short grasses of the prairie and open pine woods, especially in an association of *Dichromena floridensis*, *Rhynchospora divergens* and *Distichlis spicata*.

Lonatura catalina Osborn and Ball (Plate IV, figs., 5, 5a, 5b)

Lonatura catalina Osborn and Ball, Proc. Dav. Acad. Sci., VII, p. 83, 1898.

The smallest species and type of the genus varying in color from light yellow to dark brown. Usually orange yellow in color. Length 1.85 to 2.75 mm.

Vertex flat, bluntly angled, length at middle equaling basal width between eyes. Pronotum a little shorter than vertex and more than twice as wide as long. Elytra in brachypterous forms covering only two abdominal segments; in macropterous forms extending beyond abdomen.

Color varying from pale yellow to dark brown. Vertex almost always pale; ovipositor black, most are yellowish washed with orange.

Genitalia: Female last ventral segment longer than preceding, side margins short, narrowed from these to form rounded angles. Posterior margin shallowly emarginate, either side of a broad bifid tooth, at middle. Lobes of underlying membrane conspicuous. Male valve short, broadly triangular. Plates three-fourths as long as combined width at base, slightly concavely narrowed to pointed apices.

Described from Iowa and South Dakota by Osborn and Ball. It has since been reported for Tennessee (De Long) and Chicago, Illinois (Ball). It occurs in great abundance in the *Aristida gracilis* association of the *Andropogan* area in Tennessee. In Iowa, Ball reports it occurring on *Sporobolus*.

Lonatura salsura Ball (Plate IV, figs., 9, 9a, 9b)

Lonatura salsura Ball, Can. Ent., xxxi, p. 310, 1899.

A rather large, blunt headed species without definite color markings. Length 4 to 4.5 mm.

Vertex bluntly angled, one-third wider between eyes than length at middle. Pronotum longer than vertex and twice as wide as long. Elytra covering only first two dorsal segments of abdomen in brachypterous forms or exposing only the tip of the ovipositor in the long winged form.

Color: Pale sordid yellow, sometimes washed with brownish on vertex and pronotum. Tergum often with brown lines or markings. In well marked specimens a pair of dark spots are on the apex and an oblique pair are near the base of the vertex.

Genitalia: Female last ventral segment roundingly emarginate, either side of a prominent median tooth as long as its basal width. The lateral angles are deeply roundingly excised to expose a rounded lobe at either side, portions of an underlying membrane. Male valve very small only one-third the width of the last ventral segment and scarcely produced beyond it. Plates triangular concavely rounded to pointed apices.

Specimens in the Ball collection are from Ft. Collins, Greely, Lamar, Holly, and Julesburg, Colorado, and Monroe and Dixie, Utah, and Stratton, Nebraska.

Lonatura melina, new species (Plate IV, figs., 7, 7a, 7b)

Resembling *salsura* in form and appearance but with more produced vertex and female segment without a tooth. Length 3.75 to 4.25 mm.

Vertex bluntly angled, a little wider between eyes than length at middle. Pronotum twice wider than long and a little shorter than vertex. Elytra as in *salsura* covering only the first two segments of abdomen.

Color: Pale sordid yellow, with a few mottled darker markings. Ocelli reddish, a row of four very pale spots extending between these along margin of vertex.

Genitalia: Female last ventral segment a little longer than preceding. Side margins short, gradually narrowed to posterior margin, which is slightly trilobate. The central lobe is more narrow and slightly sunken and is separated from the broader outer lobes by a slight indentation. Lobes of underlying membrane conspicuous. Male valve rounded and only slightly visible in concavity of last ventral segment. Plates longer than last ventral segment. Gradually narrowed to rather blunt tips.

Described from a series of eight females and nine males collected by Dr. E. D. Ball and in his collection. Specimens are from Richfield, Utah, Aug. 8, 1906, Monroe, Utah, July 25, 1906, Ephraim, Utah, July 20, 1914, Manti, Utah, Aug. 31, 1905, and Ridgeway, Colo., July 31, 1900. These are the only specimens now known.

Type: Male; Richfield, Utah, August 8, 1906. Collection of Dr. Ball.

Lonatura noctivaga Ball (Plate IV, figs., 4, 4a, 4b)

Lonatura noctivaga Ball, Can. Ent., xxxii, p. 342, 1900.

Resembling *salsura* in general form and appearance, but larger and with four large black spots above margin of vertex and two on each elytron. Length 4 to 5.5 mm.

Vertex bluntly angled, almost one-fourth wider between eyes than length at middle. Pronotum rather short and broad. Elytra in brachypterous forms covering only first two abdominal segments, in macropterous forms reaching to tip of ovipositor.

Color: Pale dirty yellow, vertex with a pair of large black spots just above apex and another pair between these and ocelli dark brown. Some darker irregular markings on disc of vertex. Elytra with a spot on middle of outer clavus and another on posterior margin near middle dark brown.

Genitalia: Female last ventral segment longer than preceding, side margins short, posterior margin roundingly produced to form posterior margin. Central fourth in the form of a broad, slightly produced, brown margined tooth. This portion apparently forming a broad keel. Side lobes of underlying membrane conspicuous. Male valve short, and broad, roundingly triangularly produced. Plates rather long gradually narrowed to rather blunt apices. Known at present only from the type specimens in the collection of Dr. Ball from Lamar and Rocky Ford, Colorado.

Deltocephalus nebulosus Ball (Plate IV, figs., 8, 8a, 8b)

Deltocephalus nebulosa Ball, Can. Ent., xxxii, p. 342, (1900).

Resembling *D. obtectus* in form, coloration and general appearance, with four black spots just back of vertex between ocelli and with female segment slightly roundingly produced. Length 3 to 3.5 mm.

Vertex blunt, scarcely angled, a little wider between eyes than median length. Pronotum longer than vertex and twice as wide as long. Elytra longer than in related species, rounded at the apex instead of squarely incised and extending over the first five abdominal segments.

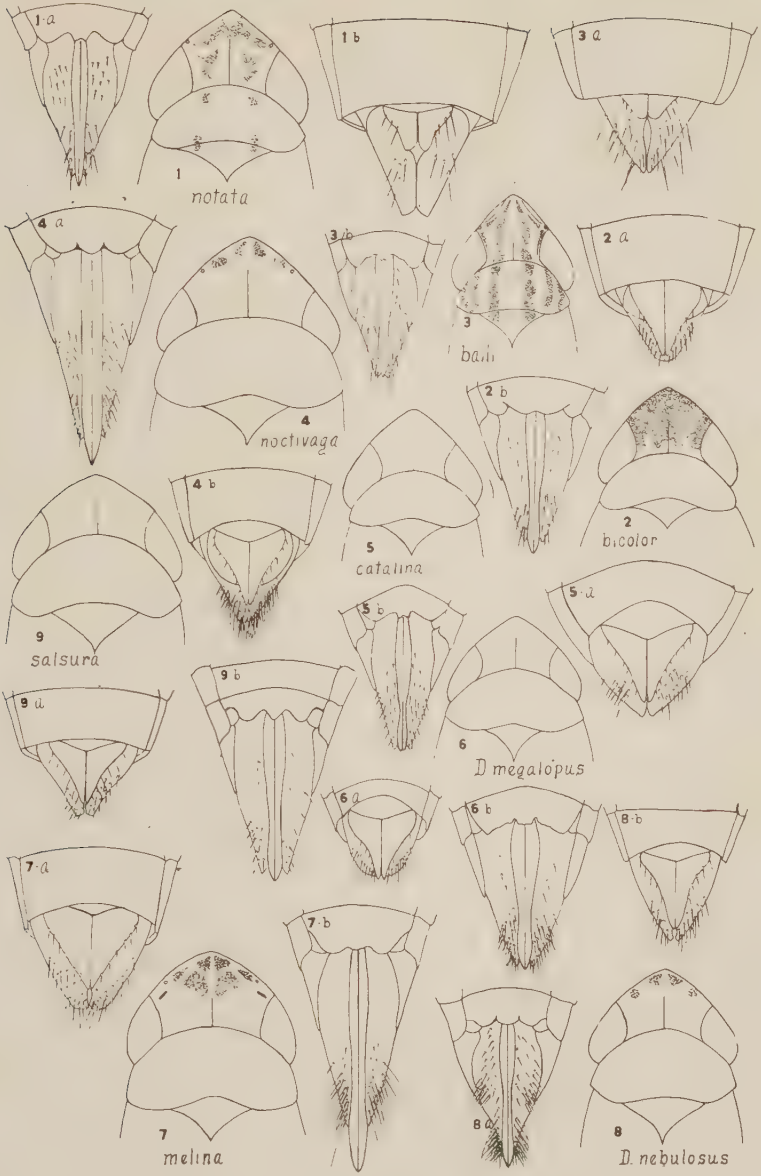
Color: Dirty straw; a pair of large angular spots just above apex of vertex and a pair of large round ones between these and ocelli. A paler interrupted band behind these and an oblique dash next either eye at the base. Pygofer with a black marking dorsally.

Genitalia: Female last ventral segment as long as preceding, side margins very short, concavely narrowed to posterior margin which is slightly produced and sinuated. Disc strongly elevated and embrowned. Male valve short, about two-thirds as wide as last ventral segment and lying in its concavity. Plates rather long, concavely constricted at half their length, then produced and convexly sloping to bluntly tipped apices.

Known only from the type pair in the collection of Dr. E. D. Ball, collected at Fort Collins, Colorado, July 24, 1899, and Aug. 16, 1902. A close examination of this species and a comparison with others in the *Deltocephaloid* group, seems to indicate that *nebulosus* is more closely related to *D. obtectus* and related species than to species of *Lonatura*. It is therefore referred to that genus.

EXPLANATION OF PLATE IV.

Fig. 1. *Lonatura notata* Osb. Head;1a female genitalia; 1b male genitalia. Fig. 2. *Lonatura bicolor* V. D. Head; 2a male genitalia; 2b female genitalia. Fig. 3. *Lonatura balli* DeL. Head; 3a male genitalia; 3b female genitalia. Fig. 4. *Lonatura noctivaga* Ball. Head; 4a female genitalia; 4b male genitalia. Fig. 5. *Lonatura catalina* O & B. Head; 5a male genitalia; 5b female genitalia. Fig. 6. *Deltocephalus megalopus* Ball. Head; 6a male genitalia; 6b female genitalia. Fig. 7. *Lonatura melina* DeL. Head; 7a male genitalia; 7b female genitalia. Fig. 8. *Deltocephalus nebulosus* Ball. Head; 8a female genitalia 8b male genitalia. Fig. 9. *Lonatura salsura* Ball. Head; 9a male genitalia; 9b female genitalia.



DELONG—NORTH AMERICAN CICADELLIDAE

NEW GENERA AND SPECIES OF MEMBRACIDAE

BY FREDERIC W. GODING

CENTROTINAE.

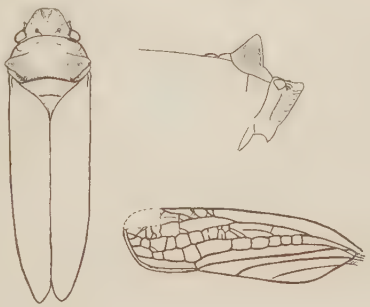
WILLIAMSIANA new genus

Vertex of head horizontal, a tubercle each side in front with a longitudinal sulcus between them; ocelli near eyes and base; eyes very large, transversely oval and curved backward; front long, broad, swollen, convex, striated horizontally with a broad deep longitudinal sulcus. Pronotum with base straight, posterior margin curved forward immediately behind humerals, destitute of posterior process, a short, stout, conical horn each side above humerals directed outward and upward, metopidium convex declivous. Scutellum triangular, front margin sinuate, a transverse sinuate sulcus at apical third, apex a short slender spine. Margins of tegmina parallel, apical margin obliquely truncate, the rounded apices extended just beyond apex of the long robust abdomen; corium with two longitudinal veins, the ulnar percurrent, the radial forked toward base, apical third with many irregular cells; apex of clavus acuminate; wings with four apical cells, second sessile, third longest and stylate. Legs long, slender, spinulate.

Genotype: *ferruginosa*, new species.

Williamsiana ferruginosa new species

Ferruginous, densely and coarsely punctured including pronotum, scutellum and tegmina which also are rugulose. Tegmina green excepting veins which are ferruginous red and very irregular; wings reddish hyaline, veins red, broader at basal third than tegmina, and about as long. Base of pronotum produced horizontally forward with a deep transverse sulcus and two raised lines just above. Long. apex abdom., 18; apices teg., 20 mm.



Williamsiana ferruginosa Goding, × 2 (Williams del.)

Type: Female; Baños, Ecuador, (Feyer).

It greatly differs from all described species, in some characters similar to certain Cercopids. The genus is dedicated to Dr. F. X. Williams for his generosity in placing in my hands hundreds of examples of South American Membracidae.

Scytodepsa magna new species

Ochraceous, finely punctured. Exterior half of corium opaque black, a broad band at base of apical cells and interior half clear hyaline; wings with four apical cells, 1st small oblong base truncate, second small triangular stylate, third broad extended two-thirds distance toward base, fourth half as long, bases of two last obliquely truncate. Below, body concolorous, apices of femora, tibiae and tarsi black. Long., 7; lat., 2 mm.

Type: Female; Napo River, Ecuador, (Williams).

It differs from *exigua* Fabr. in being more than double the size, and body below ochraceous instead of black.

EUWALKERIA new genus

Head impressed on fore border; pronotum tuberculate, median carina obsolete, destitute of suprahumeral or posterior processes; tegmina hyaline; tibiae dilated, compressed. Genotype: *Æthalion latipes* Walker.

Walker stated that his species did not belong to any known genus, placing it provisionally in *Æthalion*. Type in British Museum.

Tropidaspis jubata, new species

Fuscous brown, chest, head below vertex, short lines at front of pronotum, tips of denticulated exterior angles of vertex, and basal third of tegmina, black. Sulcus at base of vertex narrow, deep, exterior angles as prominent teeth. Dorsum of pronotum very tumid, median carina foliaceously elevated at middle; apical margins of tegmina rounded. Long., 5; lat., 2.5 mm.

Type: Female and 3 ♀ paratypes; Tena, Ecuador, (Williams).

Differs from *carinata* Fabr. in the color, and markings, and larger size.

Æthalion picta new species

Female. Head yellow, basal and apical margins vertex, transverse bands on face, black, shining. Pronotum shining black, a smooth percurrent median line, another each side abbreviated at each end, and broken line extending from eyes to humerals, yellow margined with black below, sides not foliaceous. Tegmina with clavus and broad space between costa and radial vein and veins of apical half blood-red, basal half of veins of clavus and its interior margin yellow; all cells of corium excepting costal space, broad apical margin, and two streaks at base, black, opaque; below, chest and abdomen yellow; legs black, posterior tibiae and tarsi with broad yellow ring. Long., 12; lat., 4 mm.

Type: Female; Napo, Ecuador, (Felton).

Differs from any species of the genus known to me, but may be easily recognized by the beautiful yellow, red and black markings.

EUSTOLLIA new genus

Long, narrow, head carinate at base sometimes sulcate at middle; pronotum armed on dorsum with an elevated process extended upward and forward curving over the head, destitute of a posterior process; legs long and slender. Genotype: *Cicada jubata* Stoll. Locality of type, unknown.

This genus is formed to include Stoll's figure 34 on plate 7, described on page 37 of his Cigales, from Surinam; *Tropidaspis cornuta*, Haviland and *Tolania punctata* Met. & Brun.

Orthobelus felinus new species

Light ferruginous, pubescent; head truncate below eyes which are very prominent and almost lobate, margined with a raised testaceous line. Pronotum convex, depressed on dorsum, a thin acuminate spine each side above humerals, their apices fuscous, the pubescence on front and dorsum arranged in a serrated manner each side; lightly punctured, a median percurrent carina much darker on dorsum and at apex; posterior process triquetrous, short, two-thirds as long as abdomen, narrow, sides parallel from base, briefly acuminate, a sinus at base and lightly gibbous, fuscous. Tegmina with basal third fulvous, brown spot on base of clavus partly hyaline, veins fuscous, cells near middle infuscate. Body below entirely testaceous, densely

pubescent; tibiae with three broad fuscous rings, articulations and tips of tarsi fuscous. Long., 4.75; lat., 2 mm.

Type: Female; Phoenix, Arizona (Stromberg).

Similar to *havanensis* Fairm. It is much smaller, posterior pronotal process shorter, and a much paler color.

FLEXOCENTRUS new genus

Head broader than long, base arcuate, emarginate; ocelli equidistant from eyes and each other. Pronotum with stout suprahumeral horns, and percurrent median carina; posterior process not distant from scutellum, slightly longer than abdomen, triquetrous, lateral margins and dorsum sinuate, apex acute. Scutellum broad as long, apex truncate emarginate, angles denticulate. Tegmina semiopaque, clavus acuminate towards apex; corium with one discoidal cell, and five apical cells, the first, second and third lying on exterior margin, fourth and fifth occupying the oblique posterior margin; ulnar vein forked at middle. Legs simple. Genotype: *Centruchoides felinus* Haviland. Genotype in American Museum Natural History, New York.

This species has very little in common with the genus *Centruchoides*, and does not fit into any described group, its venation approaching that of the genus *Lycoderes*.

Cyphotes insolitus new species

Female.

Head large, lengthily produced in a porrect cone, pubescent, sides testaceous; vertex long with a slight longitudinal sulcus and laterally depressed each side containing the ocelli which are equidistant from eyes and each other on a line with center of eyes and very distant from base. Pronotum greenish yellow, lightly punctured, base arcuate, a strong percurrent median carina; humerals produced in broad flat auricular processes extended directly outward, apices very suddenly rounded in an acute slender spine; dorsum sparingly and finely tuberculate, a broad stripe extending from apex of head to space between the two dorsal humps of posterior process; that process is immaculate with some irregular raised lines each side of acute apex; tips of humeral processes piceous. Tegmina vitreous, apical third fuliginous exteriorly. Body below piceous, tarsi sordid yellow. Long., 6; lat. int. hum., 4 mm.

Type: Female; Tena, Ecuador, (Williams).

It differs from *nodosa* Burm. the only other member of the genus, in the longer head which is pointed, not truncate, the nodes on the posterior pronotal process begins much smaller

and not produced beyond the lateral margins, the greenish yellow color with broad piceous central stripe, and smaller size.

Hyphinoe inermis new species

Uniform piceous brown, thickly and coarsely punctured, pubescent. Head long triangular; ocelli equidistant from each other and eyes; median sulcus interrupted at middle, sides and apex paler, apex acutely produced downward, hirsute. Basal margin of pronotum arcuate; metopidium tumid, its lateral margins diverging upward, a black spot above each eye, superior margin well rounded, angulate each side, destitute of lateral horns, a strong median carina from base; suprahumerals barely angulate, obtuse, piceous; dorsum slightly sinuate, apex not reaching tips of tegmina, the slender apical part and narrow lateral margins shining black; hirsute. Tegmina dark yellow hyaline, costal space darker, veins strong, brown. Below, chest and legs concolorous, tarsi yellow; abdomen with basal half and large spots on apical half yellow.

Stature of *asphaltina*, metopidium more tumid, it is more hairy, and differs in markings. A variety has basal half of head, and four quadrangular spots on base of pronotum, yellow, apex of head black. Long. cum teg., 13; lat., 6 mm.

Type: Female; Pasorja, Ecuador, (*Campos*), 1 female paratype.

Alcmeone unistriga new species

Uniform shining black, densely gray pubescent, strongly evenly coarsely punctured, a pale yellow stripe on vertex. Head triangular, pubescent, base lightly sinuate; ocelli equidistant from each other and eyes; breadth with eyes equal to base of pronotum; surface uneven, a central pale yellow stripe from base to middle of head. Pronotum well elevated, a percurrent median carina, metopidium perpendicular; suprahumerals seen from front thin, nearly horizontal and concave between bases anteriorly, seen from above very broad, flat, sides parallel, curved outward their hind side concave, tips very suddenly ending in acute point; deeply impressed above humerals; posterior process highest at base behind horns, seen from side sinuate at middle, seen from above margins sinuate, apical half slender the apex deflexed reaching interior angle of tegmina; sides anteriorly with deep semicircular impression and a linear impression from it to apex. Tegmina black, coriaceous, opaque and punctured to tips; wings smoky hyaline, veins strong, black, four apical cells the second

sessile. Below, dull black, margins abdominal segments narrowly pale yellow; legs testaceous, exterior sides black. Long., 12; lat. inter corn., 10; alt., 6 mm.

Type: Male; Napo River, Ecuador, (Williams).

It is near *expansicornis* Fairm; differs in the uniform shining black color, median yellow stripe on the head, black lines on the legs, pale margins of abdominal segments, acute tips of suprahumerals, and opaque black punctured tegmina.

SMILIINAE.

Stictolobus septemfasciata new species

Pale reddish brown, with seven pale yellow narrow longitudinal stripes. Head two and a half times as broad as long, basal margin lightly sinuate, rugose, shining, not punctulate, spot near and two longitudinal smooth rugae at middle, pale yellow; ocelli equidistant from each other and eyes; light reddish brown, apex produced, acute. Pronotum pale reddish brown, dot on basal margin each side of middle, median carina from base to subulate part of posterior process, lateral margins from basal angles to middle posteriorly, a curved stripe from base over humerals and converging behind but not uniting at dorsal edge, and an arcuate stripe from lateral margins at humerals curving upward and backward to and along lateral margins to subulate part of apex almost meeting behind end of median stripe; subulate part ferruginous to apex; sides with semicircular lateral impressions. Tegmina clear vitreous, veins yellow, black around apical cells. Below, concolorous, legs some paler, immaculate. Long., 6; lat., 2 mm.

Type: Female and 2 paratypes from Tena on the Napo River, Ecuador, collected by Dr. F. X. Williams, Feb. 27, 1924.

It resembles *subulata*, Say; the dorsal line is more regularly arched, not elevated behind humerals, and has two more stripes, with finer punctuation.

Parantonae binodosa new species

Black, not pubescent. Head dull black, very finely punctured, broad yellow band extends from below humerals meeting at base of clypeus; base strongly curved behind eyes straight at middle, eyes appearing to be below usual locality, quite convex and inclined backward, sides perpendicular to below eyes then oblique to apex, a narrow impressed line along middle of vertex; ocelli above a line through eyes, and nearer to eyes than to each

other; a small tubercle above each antenna; beak yellow, tip fuscous. Pronotum dull black, finely punctured, base straight exterior angles sinuous, smooth scar above each eye; median carina percurrent, weak anteriorly, strongly elevated and almost foliaceous on apical part; front part a convex dome, unarmed, rounded to base posterior process where it is strongly constricted, close behind constriction suddenly broadened in a flat, triangular elevation; behind strongly laterally compressed, suddenly inflated in a hemispherical lobe some smaller than front dome, gradually passing into apical part which is broad at base, depressed, to pointed apex which almost reaches tips tegmina. A narrow pale yellow line extends from behind eyes, each side, along lateral margins to base and up the exterior margin of the flat process; between the two lobes is a transverse yellow band to sulcus above; apical part fuscous. Tegmina black, opaque, band at basal third extending along costa briefly, another crossing first and fifth and posterior discoidal cells, another crossing fourth apical cell, and the third apical cell entirely, clear colorless hyaline; veins almost indistinguishable in opaque part; corium with two diverging longitudinal veins from base; third apical cell occupies apex, second and fourth, and first and fifth with posterior discoidal cell occupy the entire breadth of corium; there are five apical cells, and three discoidal cells, the third lying between the first and fifth apical cells, the other two lying just in front of it, near base, the basal cells very short. Below, with legs fuscous, genitals testaceous margined, beak yellow, tip fuscous. Long., 5; lat., 1.5 mm.

Type: Female; Tena, Napo River, Ecuador, (Williams).

It differs from the only other member of the genus, *dipteroides* Fowl., in absence of pubescense, dull black, light punctuation, yellow lines and bands, the compressed triangular node, very much smaller terminal lobe which is hemispherical not globular, and long strong fuscous apical spine which is almost foliaceous above, and position of ocelli.

Thrasymedes nigricosta new species

Shining green, posterior apex black. Head testaceous, margins paler, smooth, not punctulate, length one-half breadth between eyes, jugae lightly sinuate, apex triangular from eyes, tip briefly obtuse, not hairy; ocelli a little closer to eyes. Pronotum green, shining, obsoletely very finely punctulate anteriorly, distinctly punctate posteriorly, a smooth scar at base above each eye ferruginous; metopidium perpendicular, briefly rounded

superiorly, then straight to apex, the minute tip of which is black; posterior process green shaded with yellow; humerals not prominent; tegmina colorless hyaline, costa and veins on apical part black, the others green; below, chest and legs testaceous; ventral surface of abdomen with margins of segments, and apex, black. Long., 6; lat., 2.5 mm.

Type: Female, and 1 ♀ paratype; Baños, Ecuador, (Williams).

Near *pallescens*, differs in ferruginous spots on head, clouded sides, black tip of posterior process, and black costa and apical veins.

The types, where not otherwise mentioned, are in the collection of the author, and will be ultimately deposited in that of the U. S. National Museum at Washington, where my principal collection now is. Paratypes will be deposited in the collection of The American Entomological Society.

NEW SPECIES OF MEGACHILE, WITH NOTES AND CORRECTIONS (HYMENOPTERA)[1]

BY THEODORE B. MITCHELL

Department of Zoology and Entomology, North Carolina State College.

Two undescribed species of *Megachile* were found in looking through some unidentified material in the collection of The American Entomological Society at Philadelphia and I am describing these below. Further collecting and comparisons since my previous paper in the Elisha Mitchell Journal of Dec., 1924, have made necessary the descriptions and notes which follow.

Megachile abducta new species

♂. Face, up to level of anterior ocellus, densely clothed with ochraceous pubescence, that above the ocellus thin and light; mandibles with a rather large patch of long ochraceous pubescence midway from base to tip, 4-dentate, the inferior tooth basal, with a second inferior tooth located about midway from apex of basal tooth to apex of mandible, this tooth directed apically; cheeks broad and flat, quite finely punctate, angulate below, but the triangular spine-like angle largely hidden by the dense white pubescence, pubescence thin above; punctures of vertex well separated and rather shallow; lateral ocelli about equally distant from eyes and edge of vertex; scape of antenna black, flagellum red below, darker above.

Pubescence of thorax pale ochraceous above, fading to white below; mesonotum quite evenly punctate, the punctures distinctly separated medially, crowded at extreme sides, pubescence short and thin, with two oblique lines of white pubescence anteriorly; scutellum smooth and shining, punctures well separated, pubescence thin; pleura somewhat more closely and coarsely punctured than mesonotum, pubescence long below; propodeum smooth and shining, sparsely and finely punctate, pubescence long, thin and light, basal triangle shining and impunctate; tegulae red, yellow on outer anterior border, very finely punctate and with thin pubescence; wings subhyaline, dusky apically, the marginal cell with a distinct dusky band along the outer margin, nervures reddish, basal nervure considerably beyond transverse median.

[1] Published with the approval of the Director of the North Carolina Agricultural Experiment Station as paper No. 5 of the Journal Series of the North Carolina Station.

Front coxae flat and bare anteriorly, each with a patch of dense white pubescence on the outer side, and with the usual spine which is long and much flattened, rounded apically, spatula like in appearance; upper face of front femora testaceous, shading to reddish apically ,antero inferior face testaceous except on anterior border where it is dark red and also with two longitudinal stripes of the same color, posterior face very narrow for over half its length basally, sharply carinate between this and the upper face, black, punctate, with dense long white pubescence posteriorly, abruptly expanded just beyond the middle and gradually narrowed from there to the apex, the inferior border of this expanded portion narrowly ivory-colored; front tibia triangular in cross section, outer face black, coarsely and closely punctate, pubescent, yellow apically, anterior face polished and red, postero interior face laid against the antero-inferior face of femur when leg is flexed, polished and testaceous; spur pale, hollowed out like an exaggerated garden trowel; front tarsi dilated and yellow, with a posterior fringe which is pale without and ferruginous within, the darker hairs being visible from without at edge of fringe; metatarsus moderately hollowed out above, but not extending beyond the second joint, inner hair fringe of scale ferruginous; other joints short, less widely dilated to the terminal joint. Middle legs dark red to blackish, tarsi yellow, bordered posteriorly with black and with a fringe of long white pubescence, no tibial spur present, but the apical inner angle prolonged into a spur-like spine; posterior legs dark red, tarsi yellow bordered with black posteriorly, spurs pale testaceous; all the claws yellow tipped with red.

Sides of the abdomen subparallel; punctures rather fine and close basally, coarser and more sparse apically, those on the apex of the fifth segment, becoming confluent; pubescence pale, black only on the fifth segment, although becoming darker apically, and with a few scattered black hairs on the fourth segment, fasciae dense and white, continuous; sixth segment rugose, rather finely so above but becoming coarse near apex of carina, coarsely rugose below carina, carina irregular, indefinitely emarginate medially, with several irregular teeth on either side, segment with an apical carina which is indefinite medially, more pronounced on either side of middle, with a short lateral spine on each extreme side; seventh segment obtusely pointed, membranous, venter with four visible segments. Length, 13 mm.

Type. Male, Texas (no definite locality record), [Collection of The American Entomological Society, No. 10547].

This species is closely allied to *M. shermani* Mitch. from which it may be distinguished as follows:

M. shermani — More robust, abdomen broader; no conspicuous hair tuft on mandibles; pubescence on segments two and three of abdomen largely black, that on segment five mostly light; carina of segment six evenly and quite deeply emarginate, otherwise entire.

M. abducta — Less robust, abdomen narrower; a conspicuous tuft of ochraceous pubescence on mandibles above; pubescence on segments two and three of abdomen largely light, that on segment five black; carina of segment six indefinitely emarginate, irregularly toothed.

Megachile virginiana new species

♀. Supraclypeal plate with a median triangular impunctate area below, punctures strong at sides and above; clypeus closely and strongly punctured, more so laterally, with a median triangular projection and two lateral weaker ones on the apical margin, impunctate in the region of the median projection and with an impunctate line running from this to the supraclypeal plate; mandibles 4-dentate, shining, somewhat reddish apically, with scattered punctures; cheeks shining, with shallow punctures below, deeper and closer above; vertex closely and strongly punctured; lateral ocelli about equally distant from the eyes and edge of the vertex; scape of antenna black, flagellum reddish below, darker above, apical joint but very slightly flattened; pubescence of face and cheeks white, dark on vertex and between ocelli.

Mesonotum closely punctured, pubescence apparently light (specimen rubbed); scutellum strongly and confluently punctured; pleura with entirely light pubescence, punctures large and rather close; propodeum very finely and densely punctured laterally, more sparsely so posteriorly, basal triangle impunctate but finely tessellated; tegulae testaceous, shining, finely punctate; wings faintly dusky, nervures ferruginous, basal nervure beyond transverse median, recurrent nervures entering second submarginal cell at equal distances from base and apex; legs piceous, with white pubescence, ferruginous on tarsi beneath.

Punctures of first two abdominal segments fairly evenly disposed, third segment with few punctures medially, fourth and fifth segments finely and closely punctate basally, more coarsely and sparsely so apically; pubescence short and black, at least on apical segments (specimen rubbed), except for the

fasciae which are narrow and whitish, continuous on segments one to five, that on the fifth broader; pubescence of sixth segment black and erect; scopa white, black on the last two segments, and with an apical row of black hairs on the fourth. Length 10 mm.

Type: Female; Virginia, (no definite locality record), [Collection of The American Entomological Society, No. 10548].

This species runs to *Megachile* s. str. as defined by Robertson. It is easily distinguished from other eastern species in this group by the entirely black scopa on the last two abdominal segments, the scopa on the basal segments being white, and the prominent 3-angled edge of the clypeus.

Megachile brimleyi new species

♂. Face covered with dense white pubescence up to the level of the anterior ocellus; mandibles shining, polished apically, striately punctate, thinly covered with white pubescence basally, 3-dentate, the inferior tooth subbasal and acute; cheeks evenly and closely punctured, clothed with thin white pubescence which is dense and longer below; vertex liberally punctured but the punctures distinctly separated, the pubescence thin, short and light; lateral ocelli about equally distant from eyes and edge of vertex; scape of antenna fuscous or black, with short white pubescence, flagellum reddish below and black above, terminal joint dilated and flattened.

Pubescence of thorax entirely light except for some short dark hairs on the mesonotum, thin and short above, longer and more dense on pleura and below; mesonotum quite closely punctured, but the punctures distinctly separated in general, with two short oblique lines of white pubescence anteriorly and a conspicuous white line of pubescence between the mesonotum and the scutellum; scutellum punctured similarly as the mesonotum, but shining slightly more; pleura closely and finely punctured, but the surface largely hidden by the long white pubescence; propodeum shining, very finely punctured, the punctures close laterally, more widely separated posteriorly, pubescence long thin and white; tegulae reddish, paling to testaceous anteriorly, minutely punctured; wings brownish, basal nervure slightly beyond the transverse median, second recurrent nervure entering the second submarginal cell nearer apex than first does to base.

Front coxae black, bare anteriorly, each with a flattened triangular spine which is about as long as it is broad at base, before which is a patch of short red bristles, the spines and coxae in general with long white pubescence posteriorly; front femora broad medially, being somewhat produced below, the inferior edge carinate between the posterior and anterior faces, the anterior face being ferruginous and polished, the upper and posterior faces being dark red to piceous, the posterior one being finely punctate and densely pubescent; outer face of the front tibia black, punctate and white pubescent, the anterior and posterior faces polished testaceous; front tarsal joints ivory-yellow, becoming reddish apically, slightly dilated, but the first joint slightly hollowed on the anterior surface, with a moderately long white hair-fringe posteriorly, the hairs on the inner surface of the fringe being brownish in part. Middle and hind legs black, with white pubescence, the middle tarsi with a posterior white hair-fringe; pubescence on tarsi beneath ferruginous.

Abdomen finely, closely and evenly punctured, the punctures becoming somewhat more coarse and sparse apically, concavity of first segment polished and with a few scattered punctures; pubescence of first segment entirely light, that of segments two to five very short and dark except for the fasciae, segments one to five having conspicuous entire white apical fasciae; sixth segment with the usual carina which is entire and slightly depressed and pointed medially; the apical carina of the sixth segment is reddish to testaceous and quite prominent, broadly emarginate medially, most conspicuous on either side of this emargination; seventh segment barely visible in the emargination of the carina of the preceding segment, very slightly angulate; venter with four visible segments. Length 11 mm.

Type: Male; Wilmington, North Carolina, August 2, 1921, (Mitchell; on flowers of *Galactia volubilis*), [U. S. National Museum, No. 29069]. Paratypes: 4 males, topotypical; 1 male, Southern Pines, (A. H. Manee).

Of the eastern species, this is most closely allied to *integra rubi* and *amica*. The four species may be distinguished as follows:

1. Carina of 6th segment triangularly pointed.....2
   Carina of 6th segment broadly rounded.....3
2. Front metatarsus widely dilated and deeply hollowed out; 7th abdominal segment without a long terminal spine..*amica*
   Front metatarsus but very slightly dilated, although hollowed out to some extent; 7th abdominal segment prolonged into a conspicuous spine.....:*rubi*

3. Front metatarsus rather widely dilated; all the tibiae inclined to reddish; inferior mandibular tooth located about midway of base and apex of mandible.....*integra*

Front metatarsus very slightly dilated, if at all, and but slightly hollowed out; inferior mandibular tooth located nearer base than apex of mandible, narrow and acute; 7th segment obtuse, hardly visible.....*brimleyi*

Megachile brimleyi is named for Mr. C. S. Brimley, the companion of many of my collecting trips over this State.

Megachile integrella new species

♀. Clypeus and supraclypeal plate closely and deeply punctured throughout, the punctures crowded laterally and above, edge of clypeus shining, practically entire; mandibles 4-dentate, somewhat reddish apically, striately punctate, the punctures rather coarse above; cheeks shining, with thin white pubescence, well punctured, the punctures finer and more sparse above; punctures of vertex rather close medially more sparse laterally; lateral ocelli about equally distant from eyes and edge of vertex; flagellum of antenna obscurely reddish below, fuscous to black above; pubescence in region of ocelli and on vertex dark, that below level of anterior ocellus white, conspicuous on sides of face and around the antennae.

Mesonotum with short thin dark pubescence, light anteriorly and laterally, and with a fine line of white pubescence between it and the scutellum, punctures rather shallow and separated by more than their width medially, crowded laterally; scutellum with dark hair, bordered posteriorly with light hair, well punctured; pleura finely and closely punctured, covered with dense white moderately long pubescence; propodeum tessellated but hardly punctured, pubescence light, long and dense behind the wings; tegulae fuscous, very finely punctured, with an anterior patch of short white pubescence; wings brownish, basal nervure well beyond transverse median, second recurrent nervure entering the second submarginal cell slightly nearer the apex than the first recurrent does to the base; legs black with short white pubescence, that beneath the tarsi reddish yellow.

Punctures of abdomen fine and close, the pubescence entirely light on segment one, short and black on discs of segments two to five; segments one to five are fasciate, the fasciae entire white and apical, narrow medially and broader laterally on the basal segments; the sixth segment is straight in outline when viewed

laterally, with no apical lip, triangular in outline viewed from above, the two sides very slightly concave and the apex broadly rounded, pubescence black and erect basally, but white and appressed over most of its surface, that on the extreme apex being brown; scopa white, black on apical segment and on apical border of the preceding segment. Length, 12 mm.

Type: Female; Wilmington, North Carolina, June 30, 1925, (on flowers of *Hypericum sp.*), [U. S. National Museum, No. 29068]. Paratypes: 4 females, topotypical.

This is similar in appearance to *M. integra* ♀, the two being easily distinguished however as follows:

M. integra—Margin of the clypeus irregularly crenulate or denticulate; two anterior oblique white lines of pubescence present on mesonotum; no black hairs in scopa of subapical segment and those on the apical segment only partially black.

M. integrella—Margin of clypeus nearly entire; no oblique white lines of pubescence on mesonotum; scopa entirely black on apical segment and partially black on subapical segment.

M. integrella may be the female of *M. brimleyi*, since they were both caught in the same general locality, although not in the same years, and both seem quite closely allied to the corresponding sex of *integra*. Further collecting will possibly establish the relationship of these two sexes.

Megachile rubi (neglecta) Mitchell

The collection of additional material has established the fact that *M. neglecta* (*negleca*) Mitch. is the male of *M. rubi* Mitch., the two sexes having been caught together in numbers frequenting the flowers of *Rubus* during May. Unfortunately the type specimen of *neglecta*, which is 8 mm. in length, is abnormally small, the normal length for the males being about 10 to 11 mm. because of this difference in size I did not suspect the relationship, although I caught the type specimens of both on the same day on *Rubus*, but in different locations. This species is apparently oligotropic on *Rubus* and consequently has a short flight period, the early record being May 6, and the late, June 13, and these two records in different years. One specimen was caught at Wenona, Washington County, North Carolina, May 27, this being a new locality record.

Megachile audax Mitchell

On comparison of the types I find that *M. audax* Mitch. and *M. mucida* Cress. ♂ are the same. Several specimens of this species and sex were caught during the spring of 1925, in the vicinity of Raleigh on flowers of *Lupinus*, which flowers were also frequented by females of *M. semimucida* Ckll. Females of *mucida* have not been caught east of the mountain section of North Carolina and this leads me to the belief that the type male of *mucida* is the male of *semimucida*, even though I have not seen the type male of the latter species. A female of this species was identified as such by Prof. Cockerell.

Megachiloides oenotherae Mitchell

In looking over unidentified material in the collection of the American Entomological Society I found three specimens of this species, two from Cape May, New Jersey, dated June 5, and the other from Texas (Belfrage Coll.). This considerably extends the known range of the species, only two localities being recorded previously, Raleigh and New Bern, North Carolina. The characteristic pollen grains of *Oenothera* were observed in the scopa of the females.

NEW AMERICAN THYSANOPTERA

BY DUDLEY MOULTON

San Francisco

Professor D. L. Crawford in 1909 described his new genus *Ankothrips*, and species *robustus*, from specimens of thrips collected in Riverside County, Southern California, from the blossom of wild lilac (Caenothus). In 1924, Professor J. D. Hood described his species *A. diffractus* from specimens collected in blossoms of *Cercocarpus montanus* in New Mexico. *Ankothrips yuccae*, described in the present article, is the third American species of this genus, and interesting to note, is also from a semi-arid region of Riverside County, Southern California. Two other species, *A. fissidens* Trybom, from South Africa and *A. niezabitowski* Schille, from Europe, complete the list of five known species in this genus.

The description of the genus as given by Professor Crawford is here slightly modified to include the new species.

Genus **ANKOTHRIPS** Crawford, 1909.

Head wider than long, with a conspicuous anterior projection on vertex between and overhanging basal segments of antennae; dorsum reticulate or cross striate; ocelli present in both sexes. Antennae with nine segments, all freely movable, without long spines, strongly geniculate with tip of second segment drawn out into a pointed process beyond base of third segment. Maxillary palpi with three, labial palpi with two segments. Prothorax with spines on both anterior and posterior angles. Fore femora thickened. Wings present, fully developed, both pair with sides almost parallel and broadly rounded at tips; forewings with two longitudinal and four or five cross veins; costa with a row of unusually strong spines. Anterior wings uniformly pale brown or colorless.

Ankothrips yuccae new species (Pl. V, figs.1 to 3)

Measurements of female holotype: Head length 0.16 mm., width 0.22 mm.; prothorax length, 0.18 mm., width 0.28 mm.; pterthorax width 0.38 mm.; abdomen width 0.38 mm.; total body length (abdomen normal) 1.6 mm. Antennae: segment one, 30 microns; two, 75 m.; three, 75 m.; four, 69 m.; five, 60 m.; six, 48 m.; seven, 30 m.; eight, 24 m.; nine, 39 m.; total length, 414 microns. Wing length 1.08 mm., width 0.16 mm.

Color uniformly dark brown, tarsi and segments three and four of antenna lighter, translucent whitish areas at tip of segment three, and at the base and tip of segments four. Wings uniformly light brown, veins darker. Ocelli yellow with deep orange crescents.

Head including anterior projection, noticeably wider than long, anterior margin angular with deeply bifid anterior projection overhanging basal segments of antenna; cheeks strongly arched; back of head transversely striate. A pair of upward outwardly curved spines arising from the two points of anterior projection of head; interocular bristles prominent; a single small spine on inner margin of each eye back of ocelli; the six long, postocular spines are placed about one-third the distance between posterior margin of eyes and back of head. Cheeks roughened, each with several short, sharp spines. Eyes subovate, protruding, with coarse facets, slightly pilose. Ocelli much larger than facets of eyes, equidistant, with deep orange crescents; posterior pair contiguous with inner margins of eyes. Antennae with nine segments, two and one-half times as long as head; projection of second segment pointed at tip, serrate on outer sides. Segments three and four with horseshoe shaped, transparent sense areas extending about three-quarters around near tip. Sense cones transparent and barely discernable. Mouth-cone short and stumpy. Labrum abruptly constricted before the end, darkened at tip. Maxillary palpi three-segmented (24, 24, 15 microns long respectively). Labium broadly and bluntly rounded, labial palpi two segmented (3 and 21 microns long respectively).

Prothorax about as long or slightly longer than head and about one and three-tenths times wider than long. Pronotum finely and closely transversely striate. Three anterior directed spines on each anterior angle, (longest 30 microns). Ten spines along posterior margin, one (51 microns), on each posterior angle distinctly longer than the others; numerous other small spines scattered over dorsal surface. Pterthorax with anterior angles sharply defined, posterior angles rounded, sides almost parallel. Legs rather long and slender, fore femora somewhat thickened. Wings broad, anterior and posterior margins almost parallel, evenly rounded at tips; noticeably and uniformly light brown in color with darker colored veins; five cross veins. Costa with forty-two, fore longitudinal vein with twenty-eight, posterior longitudinal vein with twenty-three, spines. All spines shorter near base of wing and gradually becoming longer toward the tip.

Abdomen sub-ovate, last three segments abruptly constricted to a triangular pointed tip. Two long slender spines on dorsal surface of segment ten near tip (with two others in middle of sides) and four similar ones along posterior margin of segment nine. Other spines smaller. All spines yellow and inconspicuous.

Measurements of male allotype: Head length 0.15 mm., width. 0.20.; prothorax length 0.16 mm.; width 0.25 mm.; pterthorax width 0.35 mm.; abdomen width 0.30 mm.; total body length (abdomen normal) 1.46 mm. Antennae: segment one, 30 microns; two, 69 m.; three, 75 m.; four, 62 m.; five, 54 m.; six, 45 m.; seven, 30 m.; eight, 21 m.; nine, 33 m.; total length, 405 microns. Wings length 1.0 mm., width 0.14 mm.

Male somewhat smaller than female, lighter in color; with six long slender, yellow, almost transparent spines along posterior margin of segment nine.

Described from numerous specimens of both sexes, from Riverside County, Southern California. Holotype in author's collection. The writer is indebted to Professor E. O. Essig of the University of California who collected this striking species of thrips from yucca blossoms during April, 1925.

Food plant: *Yucca whipplei.*

This species is distinguished from *Ankothrips robustus* Crawford, also collected in Southern California: (1) by the bifid projection of the head, (in *A. robustus* the projection is rectangular), (2) by the serrate projection of the second antennal segment (*A. robustus* is simple), (3) by the placement of the cross veins in the fore wings. The two distal cross veins in this species are placed with the anterior one nearer the end of the wing than the posterior one. In *A. robustus* these cross veins are almost directly opposite from each other or the posterior one is nearer the tip of the wing. There is also a marked difference in the number and arrangement of spines along the posterior margin of the prothorax and on the two terminal abdominal segments, (4) the principle distinguishing characteristic in the male is the presence of six long slender spines along the posterior margin of segment nine. In *A. robustus* there are many short stout spines on dorsum of segment nine, with the anterior central pair much stronger and somewhat longer than the others.

Scirtothrips aceri new species (Pl. V, figs. 4 to 8)

Measurements of female holotype: Head length 0.07 mm.; width 0.12 mm.; prothorax length 0.075 mm.; width 0.135 mm.; mesothorax width, 0.162 mm.; abdomen width, 0.195 mm.; total body length 0.8 mm. Antennae segment one, 15 microns; two, three, four and five, 36 m.; six, 39 m.; seven, 7 m.; eight, 12 m.; total length, 0.21 mm. Wing length .55 mm.

Color brownish yellow. Head light yellow; thorax light orange yellow; abdomen light yellow with a conspicuous light brown spot on each side of abdominal segments two to eight. Antennae, segment one, light transparent yellow, two, light yellowish brown, three to eight brown, shading uniformly to dark brown at the tip. Legs concolorous with body with dark brown spot at tip of all tarsi. Wings quite uniformly light yellowish grey. Eyes deep red by reflected and black by transmitted light. Ocelli bright orange with darker orange red crescents.

Head one and one-half times as wide as long, emarginate in front with slight concave depressions to receive basal segments of antennae, constricted behind the eyes. Spines on head inconspicuous. Eyes comparatively large occupying major portion of each side of head, pilose. Ocelli approximate, separated from inner borders of eyes. Mouth-cone long pointed, triangular in outline, reaching to mesosternum, with a black-brown tip. Maxillary palpi with three segments. Antennae with eight segments, approximately three times as long as head; forked sense cones on segments three and four, simple sense cones on segments five and six. Segment three distinctly pediculate with the small lower portion set off by a clear white ring.

Prothorax about as long as head but more than twice as wide. Slightly constricted in front and behind, with a distinct emargination in the center of each side; finely transversely striate; two prominent rather short and strong spines on each posterior angle, numerous other spines but none are conspicuous. Mesathorax largest, sides strongly arched. Distinct emargination between mesa- and metathorax. All legs slender, without conspicuous spines. Wings fully developed, fore wings broadest in basal one-third, narrowing gradually to a pointed tip. Fore longitudinal vein with two groups of three and five spines in basal third of wing, and a group of four in distal half. Posterior longitudinal vein with four scattered spines.

Abdomen broadly ovate, third segment widest, fourth to ninth segments diminishing gradually to the bluntly pointed tip; spines on two terminal segments rather short; comb on posterior edge of segment eight present but inconspicuous.

Described from numerous females and one male from Redwood City, California. Holotype in author's collection.

Food plant: Maple leaves, found almost exclusively on the under side of the leaves. These specimens were collected in August, 1925, and appeared to be rather sluggish, showing no signs of springing. It is possible that they would be more active earlier in the year.

Anaphothrips priesneri new species (Pl. VI, fig. 9)

Measurements of female holotype: Head length .11 mm., width .13 mm.; prothorax length .10 mm., width, .13 mm.; mesothorax width .24 mm.; abdomen, width, .25 mm.; total body length, 1.11 mm. Antennae segment one, 18 microns; two, 33 m.; three, 45 m.; four and five, 39 m.; six, 45 m.; seven, 9 m.; eight, 12 m.; total length, 240 microns. Wing length: .71 mm.

Color yellowish brown. Pterthorax orange brown, abdominal segments 1 to 8, brown with distinct yellow band across posterior margin of each segment. Antennae uniformly brown except segment one which is clear yellow. Legs concolorous with body with tips of tibiae and all tarsi yellow. Wings clear with prominent brownish yellow veins and with an irregular brownish spot near base of wing where posterior longitudinal vein branches from anterior one. Ocelli yellowish brown with orange brown crescents.

Head somewhat wider than long, round in front, cheeks arched; without conspicuous spines. Eyes prominent, protruding. Ocelli approximate, separated from inner margins of eyes. Mouth-cone triangular, pointed, reaching almost to mesosternum. Antennae with eight segments, (sixth segment without suture) slightly more than twice as long as head. Sense-cones transparent and very inconspicuous. Segment three pediculate.

Prothorax about as long as head, somewhat wider, without conspicuous spines. Mesothorax widest. Legs slender. Wings fully developed, reaching to tip of abdomen. Ring veins and both longitudinal veins well developed. One cross vein between costa and fore longitudinal vein, near center of wing. A row of twenty-six spines along costa; fringe on posterior margin of wings sparse, anterior margin without fringe. Anterior longitudinal vein with three or four scattered spines and posterior vein with eight scattered spines.

Abdomen elongate ovate. Six spines along posterior margin of segment nine longest, spines on tip of segment ten short and inconspicuous.

Described from numerous females from Modesto, Stanislaus County, California. Holotype in author's collection.

Food plant: Weeds.

Mr. A. L. Rutherford, Horticultural Commissioner of Stanislaus County, Modesto, California, collected these specimens from weeds several years ago. The writer takes pleasure in naming this species after Dr. H. Priesner who has been most helpful in reviewing many specimens and comparing our American forms with European species.

Liothrips corni new species (Pl. VI, figs. 10 to 13)

Measurements of female holotype: Head length 0.25 mm.; width 0.21 mm.; prothorax length 0.16 mm.; width, including coxa, 0.38 mm.; mesothorax width 0.48 mm.; abdomen, width 0.58 mm.; tube length 0.21 mm.; width 0.075 mm.; total body length 2.5 mm. Antennae segment one, 30 microns; two, 60 m.; three, 87 m.; four and five, 78 m.; six and seven, 69 m.; eight, 36 m.; total length, 507 microns. Wings fully developed, but without fringe, length, 0.83 mm.; width 0.1 mm. (paratype, with fringe, length 0.9 mm.; width 0.1 mm.).

Color blackish brown except antennal segments three, four and base of five which are deep yellow, facets of eyes light yellow. Deep red pigmentations throughout body. All tarsi dark brown. Fore wings shaded light brown, with broad median darker brown streak extending from base for about two-thirds length of wing where it fades out. Base of wing clear white except median streak, anterior margin darker brown. Posterior wing shaded brown only faintly with indistinct light median streak in basal one-half.

Head about one fifth longer than wide, broadly rounded in front between the eyes, frons projecting slightly over basal segments of antennae. Cheeks almost parallel, constricted slightly posteriorly; edges roughened, with two or three short sharp spines on either side. Postocular spines prominent. Eyes protruding in front and with a slight emargination on the side, with small facets, sparsely pilose. Ocelli present, anterior one on apex and posterior ones bordering inner margins of eyes.

Mouth-cone broadly joining head, triangular, reaching to posterior margin of prosternum, pointed at tip. Maxillary palpi two-segmented. Antennae with eight segments, about twice as long as head. Segment two with sense area on dorsal surface. Segment three and seven each with one simple sense cone; segments four, five and six each have three simple sense cones.

Prothorax two-thirds as long as head and including coxa, two and one-half times as wide as long; it bears two spines on anterior margin, one on each anterior angle, one near the middle of each side and two at each posterior angle. All spines long, dark brown and pointed. Pterthorax with sides only very slightly convex, fore angles sharply angular; slightly constricted posteriorly and joining the abdomen broadly. Legs long, slender, only fore femora slightly thickened; tarsi with a small tooth near tip, which is very difficult to see unless protruding from its sheath.

Fore-wings short, reaching only to sixth abdominal segment, about nine times longer than broad, without fringe. Fore and posterior edges almost parallel over complete length of wing, broadly rounded at tip. Three long, strong, brown spines along outer anterior margin near base. Fore-wings (in paratype) with fully developed fringe bearing five or six interlocked hairs near tip. Forms with or without fringe, appear about equally divided and in both sexes.

Abdomen elongate ovate, tapering gradually to eighth segment which is constricted noticeably in posterior half. Tube about one-third as long as head, narrow; circlet of hairs at tip inconspicuous but almost as long as tube itself.

Males equally numerous as females, similar but about one-fifth smaller. Fore wings equally developed, either with or without fringe. measurements of male allotype: Head length, 0.22 mm.; width, 0.18 mm.; prothorax length, 0.15 mm.; width 0.31 mm.; mesothorax width 0.38 mm.; abdomen, width 0.43 mm.; tube length, 0.2 mm.; width 0.06 mm.; total body length 1.80 mm. Antennae: segment one, 27 microns; two, 48 m.; three and four, 72 m.; five, 69 m.; six, 66 m.; seven, 60 m.; eight, 36 m.; total 450 m. Wings fully developed with fringe; length 0.78 mm.; width 0.09 mm.; (paratype, without fringe, length 0.75 mm.; width 0.07 mm.).

Larvae conspicuous in all stages because of their bright red pigmentation. Head, prothorax, two terminal abdominal segments, antennae except third segment, and all legs, dark brown; other parts of body clearly transparent, shaded only very slightly with light brown but with conspicuous dark brown spines.

Described from adults of both sexes and larvae taken from July to October, at Mountain View, California. Holotype in author's collection.

Food plant: *Cornus pubescens* (Dogwood).

Thrips (Ctenothripella Pr.) **gillettei** new species (Pl. VI, figs. 14 to 17)

Measurements of female holotype: Head length 0.09 mm., width, 0.11; prothorax length, 0.12 mm., width, 0.12 in front, .018 behind; mesothorax width, 0.24 mm.; abdomen width 0.24 mm.; total body length 1.33 mm. Antennæ: segment one, 15 microns; two, 30 m.; three, 36 m.; four, 30 m.; five, 27 m.; six, 42 m.; seven, 18 m.; total length, .20 mm.

Color dark brown. Head and tip of abdomen darker, orange yellow pigmentation throughout entire body interconnecting tissue of abdominal segments light yellowish brown. Antennæ dark brown, concolorous with body except base of three which is light gray or yellowish brown. Eyes with deep purple pigment; ocelli yellowish with deep orange red crescents. Legs dark brown except all tarsi which are light yellowish to greyish brown and for tibia which are yellowish grey bordered on the outer and inner margins with dark brown. Wings uniformly light brown, veins darker, with elongate, white transparent area about one-quarter length of wing from base

Head comparatively small, only a little wider than long; broadly and flatly rounded in front; cheeks very slightly arched, back of head transversely striate. Eyes subovate, slightly protruding, occupying about three-fifths the side of the head, pilose. Ocelli well-developed, equidistant, posterior ones contiguous with inner margins of eyes.

Mouth-cone triangular in outline, short, reaching only to middle part of prosternum, blunt at tip. Maxillary palpus with three segments, third as long as first and second combined (6, 9 and 15 m.). Labial palpus with two segments, first very short, second rather long (3 and 15 m.). Antennæ with seven segments, slightly more than twice as long as head; sixth segment largest, fifth smallest of the median segments. Segment three distinctly pediculate with a single, short, forked sense cone on the outer dorsal tip. Segment four with a similar forked sense cone on outer ventral side near tip. Segments five and six each with two simple sense cones.

Prothorax semi-trapezoidal in shape, wider across anterior margin than greatest width of head and about one-third wider

near posterior margin. Anterior angles well defined, posterior angles broadly rounded. No prominent spines on anterior angles; a single long inner spine on each posterior angle with an outer one about one-half its length; a row of five spines on each side along posterior margin, the outer three of which are closely placed and near the base of the large spine. Other minute spines scattered over dorsum. Mesothorax largest with front angles broadly rounded. Metathorax narrower with sides gradually constricted toward the back. Legs slender, fore femora somewhat enlarged, several short rather stout spines on inner margin of posterior tibiae.

Wings fully developed, broadest in basal fifth, sides nearly parallel in central three-fifths, with front margin almost straight over outer half, and posterior margin curving forward in distal fifth to the tip. Ring vein conspicuous, longitudinal veins prominent but fading before the end. All veins marked with a series of minute darkened rings, with lighter cross lines between; with darkened spots at the base of the spines and where the fringe hairs join the wing membrane, which gives the wing a more or less mottled appearance. An elongate white transparent area at about one-quarter the wings length from the base. Spines as follows: costa twenty-three, fore vein with four spines before the light area, three to five immediately after, and three scattered in the outer half, posterior vein with seven or eight more or less regularly placed. Front fringe sparse and single; hind fringe double, long and wavy. Hind wing with single median vein extending to near tip; front fringe sparse and short, hind fringe single, long, close placed and wavy.

Abdomen elongate with three terminal segments sharply constricted and together, almost triangular in outline. Segment ten split open above for entire length. Spines on segment nine and ten long and slender, those on nine reaching tip of segment ten. Posterior margin of segments two to eight distinctly serrate.

Described from six females from Fort Collins, Colorado. Holotype in author's collection. All specimens were collected during August and September, 1925, and forwarded to me by Dr. C. P. Gillette, State Entomologist of Colorado, and I take pleasure in naming this thrips after him.

Food plants: *Helianthus, Sideranthus spinulosus? Melilotus officinalis.*

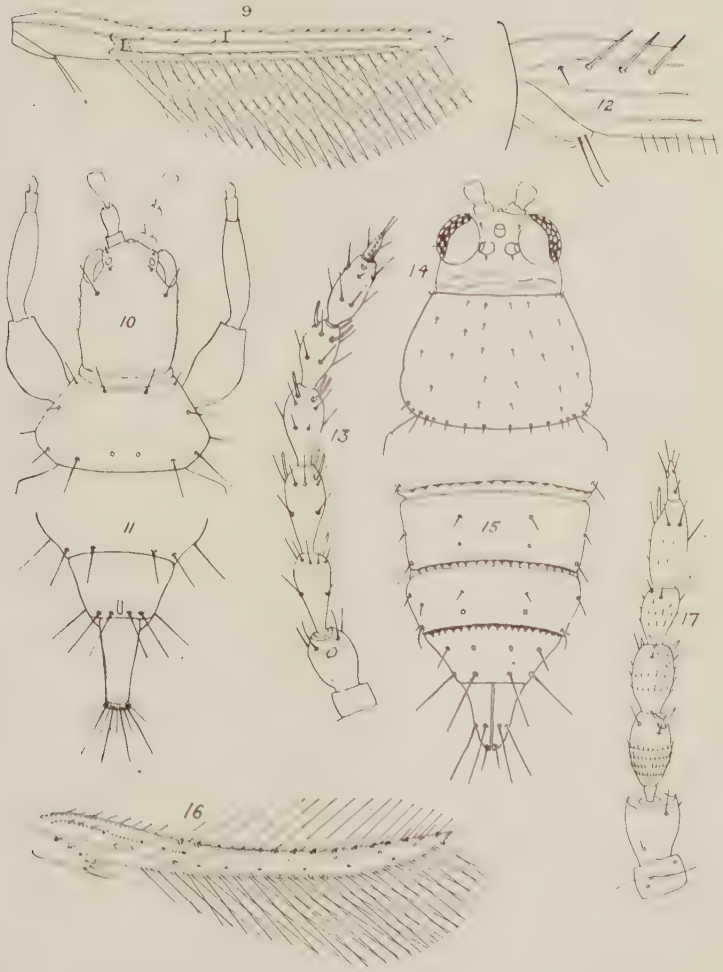
EXPLANATION OF PLATE V

Fig. 1. *Ankothrips yuccae.* ♀. Head and prothorax, dorsal view.
Fig. 2. *Ankothrips yuccae.* ♀. Enlarged vertex of head, and basal segments of antennae.
Fig. 3. *Ankothrips yuccae.* ♂. Tip of abdomen with clasping organ distended, dorsal view.
Fig. 4. *Scirtothrips aceri.* ♀. Head and prothorax, dorsal view.
Fig. 5. *Scirtothrips aceri.* ♀. Head and prothorax, ventral view showing mouth cone.
Fig. 6. *Scirtothrips aceri.* ♀. End of abdomen.
Fig. 7. *Scirtothrips aceri.* ♀. Right fore wing.
Fig. 8. *Scirtothrips aceri.* ♀. Right antennae.

EXPLANATION OF PLATE VI

Fig. 9. *Anaphothrips priesneri.* ♀. Right fore wing.
Fig. 10. *Liothrips corni.* ♀. Head and prothorax, dorsal view.
Fig. 11. *Liothrips corni.* ♀. Tip of abdomen, dorsal view.
Fig. 12. *Liothrips corni.* ♀. Base of right fore wing.
Fig. 13. *Liothrips corni.* ♀. Right antenna.
Fig. 14. *Thrips gillettei.* ♀. Head and prothorax, dorsal view.
Fig. 15. *Thrips gillettei.* ♀. Tip of abdomen, dorsal view.
Fig. 16. *Thrips gillettei.* ♀. Right fore wing.
Fig. 17. *Thrips gillettei.* ♀. Right antenna.

MOULTON—AMERICAN THYSANOPTERA



MOULTON—AMERICAN THYSANOPTERA

DESCRIPTIONS AND RECORDS OF NORTH AMERICAN BREMIDAE, TOGETHER WITH NOTES ON THE SYNONYMY OF CERTAIN SPECIES (HYMENOPTERA)

BY THEODORE H. FRISON

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A. Distributional Records

Since the publication by the writer of an article titled "Notes on North American Bremidae" in the Canadian Entomologist[1] a large number of new and important distributional records have accumulated which warrant publication at this time. So few records of the species of bumblebees occurring in South Dakota have been published that all of the data obtained by a study of a large series of specimens from this state, collected mainly by Professor H. C. Severin, are included. Most of the species herewith listed from South Dakota represent new state distributional records, and the few that do not do so are worth listing because they substantiate earlier records based upon examinations of single specimens. The South Dakota list as a whole gives a very complete idea of the bumblebee fauna of this state and the records are particularly significant because they indicate that here is a meeting ground of species with western and eastern geographical distributions. The author's reasons for the publication of such lists as this were stated in the article cited at the beginning of this paragraph and they need not be repeated here.

For the loan of material upon which these records are based I am indebted to the following: Prof. H. C. Severin, State Entomologist, Brookings, South Dakota; Mr. H. A. Scullen, Oregon State Agricultural College, Corvallis, Oregon; Mr. C. N. Ainslie, U. S. Bureau of Entomology, Sioux City, Iowa; Mr. E. T. Cresson, Jr., American Entomological Society, Philadelphia, Pa.; Mr. S. A. Rohwer, U. S. National Museum, Washington, D. C.; and Mr. H. L. Viereck, Entomological Branch, Department of Agriculture, Ottawa, Canada.

[1] Can. Ent., lvii, p. 292–296, Dec., 1925.

1. **Bremus fraternus** (F. Smith)

Interior, one queen, August 5, 1924; Wasta, one worker, September 12, 1923; Capa, one male, August 12, 1922; Springfield, one male, September 15, 1925; all from South Dakota (H. C. Severin). Previously recorded from this state (Volga) by myself (1923) on the basis of a single specimen.

2. **Bremus auricomus** (Robertson)

A good series of females from the following localities in South Dakota: Capa, Newell, White, Interior, Garretson, Pringle, Fort Pierre, Mobridge, Elk Point, Springfield and Brookings (H. ~~A. Schiller~~). Five queens, June 28–August 12 and ten workers, May 17–September 14. These records substantiate the only previous record of the occurrence of this species in South Dakota (Frison, 1923).

3. **Bremus nevadensis** (Cresson)

Loramie, Wyoming, one worker, August 8, 1922, 7250 feet altitude (J. A. G. Rehn). All castes from the following localities in South Dakota: Newell, Camp Crook, Capa, Interior and Hot Springs (H. C. Severin). One queen, June 28, 1923; four workers, July 25–August 12; three males, August 1. New state records.

4. **Bremus separatus** (Cresson)

A large series of specimens of all castes from the following localities in South Dakota: Milbank, Newell, Hot Springs, Whitewood, Wind Cave, Selby, White, Elk Point, Springfield, Meckling, Canton, Pringle, Interior, Mobridge, Belle Furche, Capa, Fort Pierre, Wentworth, Camp Crook and Brookings. Nineteen queens, June 26 August 31; thirty-five workers, July 31 August 31; thirty-seven males, August 12 September 15 (H. C. Severin). Previously recorded from this state and evidently one of the commonest species. Fairview, British Columbia, three queens, May 18, 1919, and Okanagan Falls, British Columbia, one queen, June 3, 1919 (Buckell). A new record for British Columbia.

5. **Bremus morrisoni** (Cresson)

Hot Springs, one worker, and Interior, six males, August 29, 1922, both from South Dakota (H. C. Severin). Lake County, Oregon, one queen, June 20, 1923; Corvallis, Oregon, one queen, June 2, 1924; Arlington, Oregon, one worker, June 5, 1923 (H.

A. Scullen). Wallachin, British Columbia, one male July 2, 1918 (Buckell). New state and province records.

6. **Bremus rufocinctus** (Cresson)

Whitewood, two queens, June 26–July 8, 1923; Rapid City, one queen, June 26, 1923; Belle Furche, one queen, August 2, 1924; Deadwood, one male, September 9, 1925; all from South Dakota (H. C. Severin). Vernon, British Columbia, one worker, August 22, 1923, and one male, September 5, 1923 (Gillespie); Wallachin, British Columbia, one male, July 2, 1918 (Buckell). Sioux City, Iowa, two queens, June 29, 1923 (C. N. Ainslie). Volo, Illinois, two males and one queen, margin of tamarack bog on *Carduus*, August 26–27, 1925 (T. H. Frison). The records of this species from British Columbia, Iowa and Illinois are new. In 1919, I expressed the opinion that this species would eventually be captured "in the northern part of the state [Illinois]." The capture of these specimens and those immediately following listed under diverse varietal names confirm this supposition and make a total of eighteen Bremidae now recorded from Illinois.

7. **Bremus rufocinctus** var. **iridis** (Cockerell and Porter)

Volo, Illinois, three males, on *Carduus* and *Eupatorium purpureum* along margin of tamarack bog (T. H. Frison). New state record.

8. **Bremus rufocinctus** var. **prunellae** (Cockerell and Porter)

Rapid City, one queen, June 24, 1923; Custer, one queen, July 17, 1924; Whitewood, one queen, July 18, 1923; all from South Dakota (H. C. Severin).

9. **Bremus rufocinctus** var. **albertensis** (Cockerell)

Volo, Illinois, two males, margin of tamarack bog on *Carduus* and *Eupatorium purpureum*, August 26–27, 1925, and Antioch, Illinois, one male on *Carduus*, August 25, 1925 (T. H. Frison); Pingree Park, Colorado, one worker, August 27, 1924 (Drake and Harris); Chilcotin, British Columbia, one queen, June 7, 1920 (Buckell). New locality records.

10. **Bremus rufocinctus** var. **sladeni** Frison.

Volo, Illinois, one male, August 26–27, 1925 on *Carduus* along margin of tamarach bog, Volo, Illinois (T. H. Frison). Not quite typical with *sladeni* because the apical segments have

black instead of ferruginous pubescence. It agrees otherwise, however, most closely with *sladeni* and I do not believe that a new varietal name for this specimen would be justified. New state record.

11. **Bremus occidentalis** var. **proximus** (Cresson)

Specimens of all castes from the following localities in South Dakota: Harney Peak, Spearfish, Custer, Rapid Canyon and Pringle. One queen, July 2, 1924; thirteen workers, July 16 August 14, 1924; one male, July 28, 1924 (H. C. Severin). New state record.

12. **Bremus franklini** Frison

Roseburg, Oregon, one worker, June 29, 1925 (H. A. Scullen); Gold Hill, Oregon, one worker, July 2, 1925 (H. A. Scullen). Heretofore known only from the types (Arizona and Oregon).

13. **Bremus terricola** (Kirby)

Whitewood, one worker, June 26, 1923, and Wanbay, one worker, August 18, 1924; both from South Dakota (H. C. Severin). New state record. A series of sixteen specimens of all castes of this species, rare in Illinois (Frison, 1919, 1921 and 1924), was captured at Volo, Illinois, on *Carduus*, *Eupatorium purpureum* and *perfoliatum* along the margin of a tamarack bog on August 26-27, 1925 (T. H. Frison). Pingree Park, Colorado, one male, August 15 22, 1924 (Drake and Harris). This species has been previously reported from Colorado by Titus in 1902, but Lutz and Cockerell (1920) have doubted the authenticity of his record. In view of the present record and the fact that Titus determined this species correctly from other states (Frison, 1924) it appears that his Colorado record can be accepted.

14. **Bremus affinis** (Cresson)

Volo, Illinois, six workers, on flowers of *Impatiens biflora* along margin of tamarack bog, August 26 27, 1925 (T. H. Frison). A male was observed on *Carduus* but escaped capture. First recorded from Illinois by myself in 1923 on the basis of one old specimen of a male labeled "Illinois." This species is a rarity in Illinois and is evidently strictly limited to the most northeastern corner of the state.

15. **Bremus bimaculatus** (Cresson)

Olmstead Co., Minnesota, one worker (C. N. Ainslie); Canton, South Dakota, June 16, 1924, one queen (H. C. Severin). Both are new state records.

16. **Bremus impatiens** (Cresson)

Newell, South Dakota, one queen, August 31, 1922; Elk Point, South Dakota, three workers and two males, September 15, 1925; Springfield, South Dakota, two males and eleven workers, September 14, 1925 (H. C. Severin). A new state record.

17. **Bremus ternarius** (Say)

Sioux City, Iowa, two workers (C. N. Ainslie); Big Stone City, Mobridge and Brookings, South Dakota, August 14–28, seven workers, and Brookings, April 17, one queen (H. C. Severin). Previously recorded from Iowa upon the basis of a single specimen (Frison, 1921).

18. **Bremus huntii** (Greene)

Mott, North Dakota, two queens, May 24, 1924, and two males September 27, 1922; Beach, North Dakota, one worker and three males, August 3–25, 1923; Dickinson, North Dakota, one worker (C. N. Ainslie). Fifty-six workers, July 12–August 22, and three males, July 19–August 22, from the following localities in South Dakota: Newell, Custer, Harney Peak, Pringle, Whitewood, Rapid Canyon, Spearfish and Lead (H. C. Severin). The North Dakota records are given because this species has been previously recorded from this state solely upon the basis of a single queen (Franklin, 1915).

19. **Bremus huntii** var. **rufosuffusus** (Cockerell)

Stein Mts., Oregon, one queen, June 24, 1922; Sparta, Oregon, two queens, July 2, 1922 (H. A. Scullen). This variety has not been previously reported from this state.

20. **Bremus edwardsii** (Cresson)

Gold Beach, Oregon, one male and one worker, July 10, 1925; Brookings, Oregon, one male, July 10, 1925; Grave Creek, Oregon, July 30, 1925 (H. A. Scullen). The first record of this species from Oregon.

21. **Bremus bifarius** (Cresson)

Deadwood, South Dakota, one worker, September 9, 1925 (H. C. Severin). A new state record.

22. **Bremus bifarius** var. **nearcticus** (Handlirsch)

Sparta, Oregon, four queens and two workers, July 2, 1922, and one male, July 2, 1925; Baker Co., Oregon, three queens, July 4–17, 1922; MacKenzie, Oregon, four workers and four males, August 10 12, 1925; Fish Lake, Oregon, two males, September 5, 1925; Harney Co., Oregon, one queen, July 24, 1925 (H. A. Scullen). The first record of this species and its variety from Oregon.

23. **Bremus bifarius** var **kenoyeri** (Cockerell)

Stein Mts., Oregon, one queen, July 24, 1922 (H. A. Scullen). The first record of this species (except above) and variety from Oregon. Englewood, South Dakota, one worker, June 18, 1925 (H. C. Severin). A new South Dakota species (except above) and variety record.

24. **Bremus sylvicola** (Kirby)

Banff, Alberta, Canada, one queen, June 18, 1922 (Garrett) and one worker, July 31, 1916 (F. W. L. Sladen). A new record for Alberta.

25. **Bremus couperi** (Cresson)

Edmonton, Alberta, Canada, one queen, May 27, 1915 (F. W. L. Sladen). A new record for Alberta.

26. **Bremus vagans** (F. Smith)

A large number of specimens of all castes from the following localities in South Dakota: Whitewood, Newell, Hot Springs, Spearfish, Rapid Canyon, Harney Peak, Mobridge, Piedmont Pringle, Englewood, Deadwood, Big Stone City, and Brookings (H. C. Severin). Five queens, June 18–July 12; nineteen workers, July 15–September 9; seventeen males, August 31–October 3. Vernon, British Columbia, fifty-six males, August 5–September 29; thirty-six workers, July 18 September 29, 1923, and three queens, June 5 28, 1923 (Gillespie); Vernon, British Columbia, one queen, May 12, 1920 (Venables) and one male, August 25, 1919 (F. W. L. Sladen); Fort Steele, British Columbia,

two males, September 23, 1919 (Anderson). These British Columbia records confirm the early record of this species from this locality by Smith (see notes in part C, which extends the generally accepted western range of this species.

27. **Bremus frigidus** (F. Smith)

Oregon Mt., Oregon, five workers, July 5, 1925; Grave Creek, Oregon, one worker, June 6, 1925 (H. A. Scullen). The first record of this species from Oregon.

28. **Bremus flavifrons** (Cresson)

Alsea Mount, Oregon, one male, July 20, 1921; Bellfountin, Oregon, one male, July 13, 1924; Cascadia, Oregon, one male, August 8, 1924; Alsea, Oregon, one male, August 12, 1921 (H. A. Scullen). These records are given to substantiate the previous record of this species from Oregon based upon an examination of one queen (Frison, 1921).

29. **Bremus flavifrons** var. **dimidiatus** (Ashmead)

Alsea, three queens, June 4, 1921, two workers, June 5, 1923, and August 2, 1921, one male, August 2, 1925; Rock Creek, one queen, March 19; Mary's Peak, one queen, May 30, 1924; McKenzie Bridge, one worker, August 22, 1924, two males, August 10, 1925; Wahtun Lake, one worker, August 24, 1923; Josephine Co., one male, June 30, 1925 (H. A. Scullen). All from Oregon. This variety has not been previously reported from Oregon.

30. **Bremus flavifrons** var. **ambiguus** (Franklin)

Hugo, Oregon, one worker, September 1, 1925 (H. A. Scullen). The first record of this variety from Oregon.

31. **Bremus pleuralis** (Nylander)

Laggan, British Columbia, one worker (Dyar and Caudell); Vernon, British Columbia, two queens, May 12–15, 1920 (Venables). Not previously recorded from British Columbia.

32. **Bremus borealis** (Kirby)

White, South Dakota, two queens, July 1, 1925 (H. C. Severin). Previously recorded from South Dakota (Volga) for the first time by myself in 1923.

33. **Bremus appositus** (Cresson)

Deadwood, South Dakota, one queen, three workers, and five males, September 9, 1925 (H. C. Severin). New state record and an eastern extension of the known range of this species.

34. **Bremus fervidus** (Fabricius)

A large series of specimens of all castes from the following localities in South Dakota: Lake Preston, Newell, Rapid City, Hot Springs, Fruitdale, Pringle, Lake Hendrichs, Bruce, Fort Pierre, Brookings, Belle Fourche, Lake Albert, Orman Dam, Camp Crook, Rapid Canyon, Whitewood, Deadwood, Elk Point, White, Martin, Capa, Redig, Phillip and Mobridge (H. C. Severin). Fourteen queens, June 16–August 31; eighty-one workers, June 23–October 3; thirty males, July 29–October 3. Records substantiate rather indefinite record given *in litt.*

35. **Bremus fervidus** var. **dorsalis** (Cresson)

Rapid City, South Dakota, one queen, July 24, 1923; Lake Hendrichs, South Dakota, one queen, July 12, 1923; Martin, South Dakota, one worker, June 16, 1925; White, South Dakota, one male, September 25, 1925 (H. C. Severin). The first record of this variety from South Dakota.

36. **Bremus americanorum** (Fabricius)

Heppner, Jr., Oregon, one worker, July 10, 1921 (H. A. Scullen). Franklin, in 1913, doubtfully recorded a female of this species from Oregon. The occurrence of this specimen is sufficient evidence to place this species definitely on the Oregon list. A large series of specimens of all castes from the following localities in South Dakota: Phillip, Whitewood, Deadwood, Elk Point, Springfield, Rapid City, Canton, Fort Pierre, Hot Springs, Fruitdale, Buffalo, Mobridge, Brookings, Capa, Newell, Harney Peak, Belle Fourche and Lake Albert (H. C. Severin). Ten queens, May 10–August 11; sixty-three workers, July 20–September 15; thirty-nine males, August 12–September 15. Not previously definitely recorded from South Dakota.

37. **Psithyrus ashtoni** (Cresson)

Jasper Park, Alberta, Canada, one female and five males, September, 1916 (Johansen). A new record for Alberta.

38. **Psithyrus suckleyi** (Greene)

Specimens of both sexes from Whitewood, Harney Peak, Spearfish, Rapid Canyon, Englewood and Deadwood, South Dakota (H. C. Severin). Nineteen females, June 18–July 26, twenty males, July 25–September 9. Specimens of both sexes from the following localities in Oregon: Albany, Corvallis, Alsea, Sulphur Springs, Graham, Mary's Peak and E. Toll Gate. Five females, May 30 July 15, eleven males, August 10–September 1 (H. A. Scullen). Jackson Hole, Wyoming, one female, July 5 6, 1922, 6500 feet altitude (M. Hebard); Salt Lake, Utah, one female, June 24, 1922. All new state records.

39. **Psithyrus laboriosus** (Fabricius)

One male, South Dakota; Sioux City, Iowa, one female, June 27, 1922, five males, August 17 18, 1922 (C. N. Ainslie). New state records.

40. **Psithyrus insularis** (F. Smith)

Ten males, July 21–September 9, Harney Peak, Spearfish, Deadwood and Rapid Canyon, South Dakota; Englewood, South Dakota, two females, June 18, 1925 (H. C. Severin). New state records.

41. **Psithyrus variabilis** (Cresson)

Elk Point, South Dakota, one male, September 15, 1925 (H. C. Severin); Knoxville, Tennessee, one queen (G. G. Ainslie). New state records.

42. **Psithyrus crawfordi** Franklin

Both sexes from the following localities in Oregon: Waldport, Josephine County and Alsea. One female, June 5, 1925, six males, June 5–August 18 (H. A. Scullen). Not a new record but so few specimens of this species have been captured that these additional records are valuable.

43. **Psithyrus fernaldae** Franklin.

Spearfish, South Dakota, one male, July 28, 1924 (H. C. Severin); from Gold Beach, Brookings, Waldport, Triangle Lake McKenzie Pass, Alsea Mount, Rabbit Ear Pass, Alsea, Wahtum Lake in Oregon, fifteen males, May 24 September 1, two females,

June 1 July 10 (H. A. Scullen); Cedar Mt., Idaho, one male, July 25, 1920 (Lane); Eureka, California, one male, July 4 (Dyar and Caudell); South Mts., Pennsylvania, one male, June 30, 1918 (Fouts). All new state records.

B. Descriptions

The writer's views in regard to the recognition of the more important color varieties of bumblebees have been stated in the Transactions of the American Entomological Society, Volume LI, 1925, p. 137. I consider that the following varieties warrant description and naming.

Bremus melanopygus var. **washingtonensis** new variety

Queen and *worker*.—Structurally identical with the queen and worker of *melanopygus* (Nylander) as redescribed by Franklin (1913). Differs from typical specimens of *melanopygus* in having the pubescence upon the dorsum of the second and third abdominal segment more or less tawny or golden instead of a deep ferruginous color.

Holotype.—Queen; Mt. Rainier, Washington, August, 1895, collected by C. V. Piper. *Morphotype*; Worker, E. Toll Gate (Oregon), July 15, 1906. Two *paratypic* queens; Mt. Rainier, Washington, August, 1895, collected by C. V. Piper, and Mt. Rainier, Washington, August. Holotype, morphotype and one paratype deposited in the collection of the author. One paratypic queen deposited in the collection of the American Entomological Society.

This new variety is analogous to the varieties *ternarius* var. *expallidus* (Ckll.), *bifarius* var. *kenoyeri* (Ckll.) and *huntii* var. *rufosuffusus* (Ckll.), species typically with bright ferruginous pubescence upon some of the dorsal abdominal segments.

Bremus rufocinctus var. **sladeni** new variety

Male.—Structurally identical with the male of *rufocinctus* (Cresson). Differs from typical specimens of *rufocinctus* and its various described varieties in having the pubescence upon the dorsum of the third, fourth, fifth, sixth and seventh segments almost entirely a bright ferruginous in color.

Holotype.—Male; Ottawa, Canada, September 16, 1913, collected by F. W. L. Sladen. Holotype deposited in the collection of the author. *Paratypic* male, same date as holotype, deposited in the collection of the American Entomological Society.

This beautifully colored bumblebee is named in honor of the late Mr. F. W. L. Sladen, who made large contributions to our knowledge of the biology of these social bees.

Bremus pleuralis var. **clarus** new variety

Queen and *worker.*—Structurally identical with the queen and worker of *pleuralis* (Nylander) as described by Franklin (1913). Differs from typical specimens of *pleuralis* in having the pubescence upon the dorsum of the third and fourth abdominal segments mainly ferruginous in color, the fifth and sixth segments mostly with black pubescence.

Male.—Structurally identical with the male of *pleuralis* (Nylander) as described by Franklin (1913). Differs from typical specimens of *pleuralis* in having the pubescence upon the dorsum of the third, fourth and fifth abdominal segments ferruginous-red in color, the sixth and seventh segments mostly with black pubescence.

Holotype.—Male; Tam Cod Hill, Alaska, August 31, 1920, collected by S. Hadwen. *Allotype;* Queen, Kukak Bay, Alaska, July 4, 1899, collected by T. Kincaid. *Morphotype;* Worker, Katmai, Alaska, August, 1917, collected by J. S. Hine. *Paratypes;* One male and three workers. Male, Cordova, Alaska, collected by R. H. Stretch. Workers, Katmai, Alaska, August, 1913, collected by J. S. Hine; Fort Wrigley, McKenzie River, Canada, July 23, 1922, collected by C. H. Crickmay; and Mt. Fairview, Laggan, British Columbia, August 17, 1906. Holotype, allotype, morphotype and two paratypes deposited in collection of the author. One paratypic worker is deposited in the collection of the American Entomological Society.

This brightly colored variety is the form considered by Franklin in the Transactions of the American Entomological Society, Volume XXXVIII, 1913, p. 367, simply as a "color variant" of *pleuralis* Nylander. The lack of a name for this pronounced color variety has led to the failure of recognition of specimens with this color pattern as *B. pleuralis* Nylander and their erroneous identification as other species.

Bremus terricola var. **severini** new variety

Queen.—Structurally identical with the queen of *terricola* Kirby. Differs from the typical form of *terricola* in having yellow pubescence extending nearly to the bases of the legs on the mesopleura, the entire dorsum of the thorax with yellow

pubescence except for a few black hairs on the middle area adjacent to the impunctate polished area, a few yellow hairs on the lateral posterior margins of the first dorsal abdominal segment, and the fifth dorsal abdominal segment almost entirely covered with whitish pubescence.

Holotype.—Queen; Whitewood, South Dakota, June 26, 1923, collected by H. C. Severin. Holotype deposited in the collection of the author.

This variety may be easily separated from *terricola* Kirby or any of the other species or varieties of the Terrestris Group in North America by the color patern indicated in the description. The dominantly yellow thorax is suggestive of *Bremus occidentalis* var. *proximus* (Cresson).

Named in honor of the collector, Professor H. C. Severin.

C. Notes on Synonymy

Bremus separatus var. **mormonorum** (Franklin)

Bombus mormonorum Franklin, Trans. Amer. Ent. Soc., xxxvii, 1911, p. 161, ♀ ☿ ♂.

Due to the kindness of Mr. Charles Schaeffer of the Brooklyn Museum, the writer has had the opportunity of studying cotypes of this form. The study of these cotypes and a large series of *B. separatus* (Cresson) from all parts of the range of the latter species has convinced me that *mormonorum* Franklin is only a color variety of *separatus* and not a distinct species. When *mormonorum* was described by Franklin attention was called to its close relationship with *separatus* by the statement that "it is quite possible that it [*mormonorum*] should be considered a subspecies or color variant of that [*separatus*] species." The major difference in color existing between *separatus* and *mormonorum* is that the latter has almost the entire dorsal surface of the second abdominal segment and sometimes the lateral dorsal margins of the third and fourth abdominal segments covered with a tawny yellow pubescence. *Separatus* was considered as having only the first and basal middle portion of the second dorsal abdominal segments covered with a tawny yellow pubescence.

The correctness of the synonymy just indicated, determined by a study of the structural characters of cotypes of *mormonorum* and typical specimens of *separatus*, is further established by the

study of a series of workers taken in the same nest on July 15, 1923, at The Dalles, Oregon, and kindly sent to me by their collector, Mr. C. D. Duncan. The old queen found in this nest was typical in color for *separatus*, whereas, workers from the same nest exhibited both the colors of the mother queen and the more tawny condition presented by *mormonorum*. I have seen also workers of *separatus* from Pennsylvania, Olmsted County, Minnesota (C. N. Ainslie) and Urbana, Illinois (T. H. Frison) having almost the entire second dorsal segment yellow-brown in color or tawny. Franklin, 1913, has noted worker specimens of *separatus* with the "second dorsal abdominal segment sometimes entirely covered with brown ferruginous pile." It is evident, however, from a series of specimens that the form *mormonorum* reaches its maximum development in the western regions centering around the type locality of Utah. It is for this reason that *mormonorum* is retained as a varietal name.

Bremus edwardsii (Cresson)

Bombus lapponicus var. *insularis* Friese, Deutsch. Ent. Zeitschr., 1924, p. 437, ♀.

It is unfortunate that new varieties of North American bumblebees are still being described by Europeans who do not have access to large series of North American bumblebees, and who have not had the opportunity to study the numerous types of American species existing in collections in the United States. Friese under the specific name of *lapponicus* has just recently described a supposedly new color variety of a North American bumblebee by the name of *insularis*. In the first place the presence of *lapponicus* in North America is not established. The North American species *sylvicola* Kirby is no doubt very closely related to *lapponicus*, but we do not have any conclusive proof at this time that the two are identical. The relationship of this and several other North American bumblebees with Eurasian species is being investigated by the writer at the present time.

Friese's description of variety *insularis* is based upon two queens from "Isl. Angel bei San Francisco" California. Assuming that Friese by the species *lapponicus* is referring to the species we call *sylvicola*, we are presented with the fact that *sylvicola* is a high mountain form and its presence on Angel Island near San Francisco is exceedingly doubtful. *Sylvicola*

has not been captured in California, but it may eventually be found in the high mountain regions of that state. Friese's description of variety *insularis* agrees excellently with the species *edwardsii* (Cresson). This latter species is exceedingly common in California, but is usually misidentified because of its fairly close agreement in color characters with certain other species and varieties. Structurally it is very distinct and its recognition should not cause so much trouble. I believe that there is little question that the variety *insularis* Friese is synonymous with *edwardsii* (Cresson) and that it is not even entitled to recognition as a color variety. *Bremus bifarius* var. *nearcticus* (Handlirsch) superficially resembles *edwardsii*, but is known only from the general region of Oregon, Washington, British Columbia, Montana and southern Alaska.

/Kirby

Bremus sylvicola (~~Nylander~~)

Bombus lacustris Cresson, The Labrador Coast, by A. S. Packard, N. D. C. Hodges Publisher, New York, 1891, p. 447

In the reference cited the following statement appears:—"*Bombus lacustris* Cresson. Whole Northern coast: common." This record, and the three others immediately following in the text of this article, has escaped previous catalogers of the synonymy of North American bumblebees and is therefore noted at this time. The *Bombus lacustris* Cresson is the species now going by the name *melanopygus* Nylander and occurs in the Northwestern part of North America. *Melanopygus* does not occur in Labrador, but the closely related species *sylvicola* Kirby (easily mistaken for *melanopygus*) is commonly found in collections made along the Labrador coast.

Bremus kirbyellus (Curtis)

Bombus kirbyellus Curtis, The Labrador Coast, by A. S. Packard, N. D. C. Hodges Publisher, New York, 1891, p. 447

Bombus nivalis Dahlbom, The Labrador Coast, by A. S. Packard, N. D. C. Hodges Publisher, New York, 1891, p. 447

Bremus kirbyellus (Curtis) is usually found in collections of bumblebees from Labrador. It is easily recognized because of its long malar space. In this book by Packard it is recorded from "Sloop Harbor and Hopedale" and the records in the same publication under the name *nivalis* should be accredited to this species. The *nivalis* of Dahlbom, listed by Packard in this

book from "Caribon Island and whole coast Northward," is a name applicable to one of the color variations of certain European specimens of *kirbyellus* or a closely related species. Whether any of our North American color variations of *kirbyellus* are entitled to this name remains for future solution. Certainly, however, the *nivalis* that Packard records from Labrador is not a good species. This same name has been erroneously applied by Fox, 1892, to *Bremus polaris* (Curtis) from Greenland (Frison, 1923).

Bremus frigidus (Smith)

Bombus frigidus Smith, The Labrador Coast, by A. S. Packard, N. D. C. Hodges Publisher, New York, 1891, p. 447

Recorded in this book from "Square Island and Hopedale." A common species in Labrador. It is listed here because like the preceding two species it has hithertofore escaped the notice of the cataloger.

Bremus californicus (F. Smith)

Bombus californicus Smith, The Naturalist in Vancouver Island and British Columbia, by J. K. Lord, Richard Bentley Publisher, London, 1866, Vol. 2, Appendix, p. 342

Attention is called to this name here because this record by Smith (Smith named the Hymenoptera) has been over-looked by our American students of bumblebees. The correct synonymy of *flavifrons* Smith (=*vosnesenskii* Radoszkowsky) described on page 343 of this same book, and the name *columbicus* Dalla Torre (1890) proposed as a new name for it because of the priority of *flavifrons* Cresson (1863), was worked out by Franklin (1913).

Bremus vagans (F. Smith)

Bombus vagans Smith, The Naturalist in Vancouver Island and British Columbia, by J. K. Lord, Richard Bentley Publisher, London, 1866, Vol. 2, Appendix, p. 342

Another record overlooked by previous American students of bumblebees. In Part A, of this paper are given a large number of records of the occurrence of this species in British Columbia. Except for this early record of Smith and the ones just mentioned, *vagans* has not been elsewhere listed as occurring in British Columbia.

Bombus vinatus Smith, The Naturalist in Vancouver Island and British Columbia, by J. K. Lord, Richard Bentley Publisher, London, 1866, Vol. 2, Appendix, p. 342 (*nomina nuda*).

No description of a species or variety of bumblebees by this name has ever been published and therefore *vinatus* Smith is an invalid name. The name has been overlooked in all subsequent publications. It is here listed in order that future workers will know its proper nomenclatorial status.

Psithyrus suckleyi (Greene)

Psithyrus latitarsus Morrill, Can. Ent., xxxv, 1903, p. 224, ♀

A detailed study during the last few years of a large series of specimens of *Psithyrus* from all parts of North America leaves no doubt in my mind that the male *Psithyrus* now going by the name *suckleyi* (Greene), 1860, is the opposite sex of *Psithyrus latitarsus* (Morrill), 1903, the former having priority. Although Greene's original description is very poor, Cresson's notes based upon a specimen which was apparently Greene's type of *suckleyi* are sufficient to justify the adoption of this specific name as Franklin, 1913, has already done.

The evidence that but one species of *Psithyrus* is included under the names *suckleyi* and *latitarsus*, both now appearing in our lists, is very conclusive. On the basis of structural characters both the male (*suckleyi*) and the female (*latitarsus*) belong in the Ashtoni Group of Franklin. Only one other species (*ashtoni* Cresson) is known to belong to this group in America and in this case we are positive of the correct association of the male and the female. If *suckleyi* and *latitarsus* are two separate species the male of one and the female of the other are among the greatest of insect rarities and lacking in collections at the present time. In view of what we now know about the biology of these bees, and the fact that they are an easy mark of the general collector, such a condition is altogether improbable. The abundance of males and females of these two forms in the extensive material I have examined and their exact agreement as to geographical distribution is of itself almost conclusive proof that they are the opposite sexes of the same species. Although Franklin listed them in 1913 as separate species he says: "I think that this species [*latitarsus*] is the female of *suckleyi*."

Psithyrus fernaldae var. **wheeleri** Bequaert and Plath.

Psithyrus wheeleri Bequaert and Plath, Bull. Mus. Comp. Zool., Vol. LXVII, No. 6, July, 1925, p. 265. ♀ and ♂.

The synonymizing of *Psithyrus wheeleri* Bequaert and Plath, as a variety of *fernaldae* Franklin is the result of a study and restudy of some three hundred specimens of the forms involved including, due to the kindness of Dr. Bequaert, male and female paratypes of *wheeleri*.

A careful comparative study of the structural characters of paratypes of *wheeleri* and a large number of *fernaldae* from various localities proves that these two forms are merely color phases of the same species. The volsellae of the male paratype of *wheeleri* extend very slightly farther beyond the squamae than do these of typical *fernaldae*. This may be explained by individual variation or possibly by the manner in which the parts of the genitalia set in drying. The remaining structural features mentioned in the original description of *wheeleri* appear to me to be identical with those of *fernaldae*.

Psithyrus fernaldae, particularly in the case of the male sex, is from the standpoint of color characters one of the most variable species of *Psithyrus* in North America. It is interesting to record in this connection that I have studied male specimens of *fernaldae* from a single locality in Oregon (type female of *wheeleri* is from Oregon) collected upon practically the same date that superficially resemble almost every other North American species of *Psithyrus*. *Wheeleri* is stated by its describers to run in Franklin's key (1913) to *crawfordi* Franklin. Because of its superficial resemblance to *crawfordi* and its marked departure in color from typical *fernaldae* this form certainly deserves recognition as a color variety.

Psithyrus insularis (F. Smith)

Apathus insularis Smith, The Naturalist in Vancouver Island and British Columbia, by J. K. Lord, Richard Bentley Publisher, London, 1866, Vol. 2, Appendix, p. 342.

Another record over-looked since its publication. *Insularis* is commonly encountered in collections of Bremidae from British Columbia.

A REVISION OF THE NORTH AMERICAN GENUS BELOCEPHALUS (ORTHOPTERA; TETTIGONIIDAE, COPIPHORINAE).

BY MORGAN HEBARD

This genus includes a number of species peculiar to the southeastern United States and there found only in the area recognized as the Sabalian Zone.[1] The more widespread forms are subject to much individual variation, and it was only through careful analyses of the series now available that we have been able to estimate the value of the features which have been used to separate them. All of the species are nocturnal and occur in the undergrowth on the borders of fields, in forests or swamps, often on the Saw Palmetto (*Serenoa serrulata*), the Cabbage Palmetto (*Sabal palmetto*) or the Silver Palm (*Coccothrinax argentea*). While occupied in field work we have found that one of the favorite retreats of these insects during the day is between the palmetto fans, wherever these overlapped, or in plants where a central fan was beginning to open, giving exceptionally good concealment. In such cases individuals could be readily seized, but invariably clung tenaciously to their support and bit with great strength if the opportunity offered. At night, males can be located by their vigorous stridulation. They are then more alert, but retreat slowly in a crab-like manner when approached with a light, and jump only as a last resort. Sometimes they were found to be quite fearless[2], but at other times exceedingly shy, ceasing their song long before close enough approach had been made to enable the collector to locate their position.

The genus is monotypic. Genotype.—*Belocephalus subapterus* Scudder.

[1] See Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 102.

[2] It was noted that this was usually the case when individuals were found well above the ground in cabbage palmettoes. This was true for *sabalis* at Indian Beach and *uncinatus* at Miami Beach. A sense of greater security seemed to be the cause.

The genus is characterized as follows. Form robust. Fastigium produced well beyond first antennal joint, rounded or acute conical, above smooth and neither carinate or conspicuously flattened, toothed proximo-ventrad, apex spined or rounded. Fastigium well separated from facial fastigium. Pronotal disk with lateral margins almost straight. Prosternum very strongly bispinose. Mesosternal and metasternal lobes rounded triangular. Tegmina greatly reduced in males, vestigial lateral pads in females. Ovipositor stout for the elongate slender type, weakly curved dorsad. Female subgenital plate large, embracing base of ovipositor. Genicular lobes of caudal femora unispinose.

It is of interest to note that nearest relationship is shown to the genus *Banza* Walker, which occurs in the Hawaiian Islands, there similarly developing a number of local species. The species of *Banza* are readily separated by the truncate vertex, which scarcely surpasses or is no longer than the first antennal joint and is armed with a much heavier proximo-ventral tooth; the pronotal disk, which is faintly but evidently subsellate; the less produced metasternal lobes; the decidedly less strongly reduced tegmina, which are no more reduced in females than in males; the more knife-like ovipositor, and small female subgenital plate, which does not embrace the base of the ovipositor.

To *Banza* nearest, though purely superficial, general resemblance is found in the Malagasian and African genus *Aethiomerus* Redtenbacher, belonging to the Agraeciinae.

BELOCEPHALUS Scudder

1874. *Acanthacara* Thomas (not of Scudder, 1869), Bull. U. S. Geol. Geogr. Surv. Terr., I, p. 71.
1874. *Acanthacara* Glover (not Scudder, 1869), Illustr. N. Amer. Orth., pl. 16, fig. 17.
1875. *Belocephalus* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 458.
1912. *Belocephalus*, Karny, Genera Ins., Orth., Locustidae, Copiphorinae, Fasc. 139, p. 17, pl. 3, fig. 10.

The degree of production of the lateral portions of the male ultimate tergite, depth and width of its median emargination and, in some cases, character and degree of curvature of the internal margins of the productions, constitute features which must be considered in separating the species and races of the genus. In spite of this, marked individual variation in its con-

tour occurs in some of the species. This is partially accounted for by sketches made of this tergite by Hubbell of fresh material, which show that changes sometimes take place in drying. This change is confined to the inner and less chitinous portion of the lateral projections and is due to shrinkage, resulting in a reduction of the convexity of the internal margins in some cases.

A green and a brown color phase occurs, probably in all the species. We have been able to determine, through breeding, that a green immature individual changed to brown in next to its last moult, becoming a brown adult.

To preserve the color we have found that, after evisceration, the material should be dipped for a few minutes in about a five per cent solution of formaldehyde, then dried thoroughly on blotters and packed. Blotters should also be inserted in the body cavity, to insure extraction of the liquid after dipping. This method is distinctly superior to using a stronger solution or carrying the specimens in the liquid for some time, when fading in green specimens is almost certain to result.

The following key must not be used without careful consideration of the individual variation which occurs in the species of the genus, reaching its maximum, as would be expected, in the two most widespread species, *subapterus* and *sabalis*.

A1. Female subgenital plate with lateral apices not as elongate, not reaching nearly as far as dorsal margin of ovipositor when directed dorsad. Ovipositor proportionately more elongate.[3] Male tegmina propotionately less reduced. Antennae with joints heavily spotted externally, or annulate, with blackish brown.)

B1. Male subgenital plate simple, without a spike above each style. Male cerci with ventral arm moderately decurved.

C1. Male ultimate tergite less deeply emarginate distad, the emargination rectangulate or obtuse-angulate. Male cerci with arms very short.

D1. Male ultimate tergite so broadly obtuse-angulate emarginate that the lateral apices show little production. Size small (♂ 22.3 to 31.8,[4] ♀ 24.8 to 35 mm.).

[3] Considerable individual size variation and the different average sizes of the species cause the actual ovipositor length to be of no value here, though this organ is proportionately decidedly more elongate in these species than in those of the alternate category AA1.

[4] Except in the Jacksonville region, where typical *subapterus* attains exceptional size, our largest male from there being 31.8 mm. in length.

E1. Apex of vertex armed with a decurved spine. Ovipositor averaging slightly less elongate (16.6 to 20 mm.). Pomona and Gainesville, Florida, north to southern South Carolina, southern Georgia, southeastern Alabama and west to central-western Florida.

1. *subapterus subapterus* Scudder

EE1. Apex of vertex lacking a spine or with a mere rudiment of such. Ovipositor averaging slightly more elongate (18 to 22 mm.). North-central western peninsular Florida.

1a. *subapterus rehni* Davis

DD1. Male ultimate tergite produced laterad as rounded acute-angulate triangles, so that its emargination is rectangulate or only feebly obtuse-angulate between. Size averaging larger (♂ 26.5 to 35.8, ♀ 31.2 to 35.5 mm.). (Ovipositor length averaging close to *s. rehni;* 19.7 to 21.7 mm. Male vertex averaging more elongate than in typical *subapterus.*) North-central eastern and central peninsular Florida.

1b. *subapterus peninsularis* new subspecies

CC1. Male ultimate tergite deeply emarginate distad at much less than a rightangle, the internal margins of the lateral productions so formed strongly convex distad. Male cerci with arms longer (but not as elongate as in *hesperus* or *davisi,* the ventral arm very narrow at its base. Apical spine of vertex strongly decurved, as strongly as the maximum found in *subapterus.* Size small (♂ 27 to 31.5, ♀ 31.8 mm.) Southeastern tropical Florida.

2. *uncinatus* new species

BB1. Male subgenital plate with lateral margins narrowly chitinous, cultrate, terminating on each side in a spike above the styles. Male cerci with ventral arm strongly decurved. (Male ultimate tergite with emargination rectangular or slightly less, the lateral productions thus formed with internal margins often moderately convex. Size small (♂ 26.2 to 33.1, ♀ 30 to 32.5 mm.). Ovipositor elongate, slightly less curved than in the preceding species (19 to 22.3 mm.).

C2. Apex of vertex armed with a decurved spine.

D2. Male styles reduced or wholly atrophied. Mesodistal emargination of male subgenital plate smaller and proportionately narrower. Vertex averaging shorter (♂ 1.9 to 2.3, ♀ 1.9 mm.) with the apical spine usually more decurved. Manatee, Florida.

7a. *hebardi proximus* new subspecies

DD2. Male styles extending beyond apices of adjacent spikes, rarely at all reduced. Meso-distal emargination of male subgenital plate larger and proportionately broader. Vertex averaging slightly longer (♂ 1.9[5] to 2.8, ♀ 2.2 to 3.1 mm.) with the apical spine usually less decurved. Fort Myers and Iona, Florida.
7a. *hebardi hebardi* Davis

CC2. Apex of vertex bluntly rounded, showing no trace of an apical spine. (Length of vertex ♂ 1.5 mm.). Big Pine Key, Florida. 8. *micanopy* Davis

AA1. Female subgenital plate with lateral apices more elongate reaching or nearly reaching as far as dorsal margin of ovipositor, when directed dorsad. Ovipositor proportionately less elongate. Male tegmina proportionately more reduced.

B2. Antennae with joints heavily spotted externally, or annulate, with blackish brown.

C3. Vertex short (♂ 1.7 to 2.1, ♀ 1.9 to 2.1 mm.). Form usually slightly more robust and compact. Size small (♂ 23 to 30.8, ♀ 27.8 to 31.2 mm.). Southwestern Georgia, western Florida and southern Alabama.
3. *hesperus* new species

CC3. Vertex decidedly more elongate (with Newberry series excepted,[6] ♂ 2.8 to 3.9, ♀ 3 to 3.9 mm.). Form normal, not quite as robust and compact as is usual in the alternate category. Size averaging decidedly larger (♂ 29.5 to 41, ♀ 33.7 to 41 mm.). Okeefenokee Swamp, Georgia and northeastern Florida to St. Augustine, Dunnellon and Live Oak. 4. *davisi* Rehn and Hebard

BB2. Antennae immaculate, rarely with joints showing faint suffusions of light brown.[7]

[5] This minimum found in but one specimen, all the others of the large series approaching the maximum more closely.

[6] In that series the vertex is unusually short, ♂ 2.2 to 2.3, ♀ 2.7 to 2.8 mm.

[7] In the northeastern portion of the distribution of *sabalis*, however, this feature does not hold, material from there having quite as dark and extensive antennal markings as in the alternate category. The average larger size, longer vertex and more deeply cleft male ultimate tergite separates such individuals from those of *davisi*, with which species confusion alone is possible.

C4. Face below eyes evenly tapering to vertex, giving the head an evenly conical appearance. Fastigium of vertex more elongate (♂ 2.9 to 4.3, ♀ 3.3 to 4.8 mm.), maximum length for the genus. Male abdomen often wider at apex than proximad. Male ultimate tergite deeply cleft, usually at a rightangle or slightly less, the lateral projections so formed usually sharp, but sometimes with internal margins strongly convex.[8] (Size large, ♂ 36.2 to 44.2, ♀ 39.4 to 47 mm. Ovipositor 16.7 to 20.1 mm.). Mainland of southern Florida, north to New Smyrna and Indian Beach. 5. *sabalis* Davis

CC4. Face below eyes weakly but appreciably inflated. Fastigium of vertex less elongate. Male abdomen at apex no wider than proximad. Male ultimate tergite deeply cleft, typically at a more acute angle, with lateral projections so formed sharp, typically with internal margins very strongly convex.

D3. Fastigium averaging more elongate (♂ 2.4 to 2.8, ♀ 3 mm.). Male ultimate tergite very deeply cleft. Size averaging larger (♂ 38.7 to 45, ♀ 42 mm.), form more robust. Key Vaca and Big Pine Key, Florida. 6. *sleighti sleighti* Davis

DD3. Fastigium averaging shorter (♂ 1.9 to 2.2 mm.). Male ultimate tergite deeply, but not as deeply, cleft. Size averaging smaller (♂ 34.2 to 40.8 mm.), form more graceful. Homestead and Florida City, Florida. 6a. *sleighti simplex* new subspecies

We here recognize eight species and four geographic races, of which two species and three races are here described as new. Among the six previously recognized species, we have reduced *rehni* to racial status under *subapterus* and have placed *excavatus* as a synonym of *subapterus subapterus*. We have been able to arrive at these conclusions through the study of eight hundred and twenty-eight specimens.

We particularly regret that no material has as yet been secured in several large sections of Florida, where the genus undoubtedly

[8] The form of these projections varies so greatly in *sabalis* and *sleighti* that it can not be used, as Davis supposed, to separate these species, in conjunction with slight differences in length of the caudal femur.

occurs. Material from Lake, Sumter and Citrus Counties must be studied, before the limits of the races of *subapterus* can be properly defined in that region.

The great area from Ormond to Palm Beach and far inland, particularly in its southern portion, has yielded so little that series from a number of points would give a much better conception of the distribution of *sabalis* and the significance of the variations we have noted. The presence there of one or more species of the Subapterus Group would also probably be shown.

Finally, the Florida Keys and the southern margin of the peninsula should be carefully examined. It is probable that the genus occurs in numerous places there, but it may be much more local and reduced in numbers. Our field work on Key Largo, Long Key and Key West failed in this respect, but that was due at least partially to our ignorance, at that time, of the habits of these nocturnal insects. Though probably scarcer in that region, unknown species or races are more likely to be found there than in the other territories yet uninvestigated.

In the present paper eight hundred and twenty-eight specimens have been examined. The eight species and four geographic races here recognized are all represented in the author's collection. Unless otherwise stated, the material recorded belongs to the author or the Academy of Natural Sciences of Philadelphia.

We wish to express our deep appreciation of the kind coöperation of Messrs. T. H. Hubbell, F. W. Walker, Wm. T. Davis, Professor W. S. Blatchley, Mr. A. N. Caudell of the National Museum, Dr. F. E. Lutz of the American Museum, Mr. J. A. G. Rehn of the Academy and Dr. Samuel Henshaw of the Museum of Comparative Zoology, for much assistance rendered. Mr. Hubbell not only placed in our hands all the material collected by him, but all his valuable field notes as well. Mr. Caudell sent for examination the entire series belonging to the National Museum. The value of such aid can well be realized by the specialist in such zoological groups where material is generally scarce and series rarely secured.

1. Belocephalus subapterus subapterus Scudder[9] (Pl. VII, figs. 1 and 2; pl. VIII figs. 1 and 2.)

1875. *Belocephalus subapterus* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 459. [♀; northeastern Florida; Florida.]

1905. *Belocephalus subapterus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1904, p. 795. [♀; Thomasville, Georgia.]

1907. *Belocephalus subapterus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1907, p. 303. [♂, ♀, juv.; Pablo Beach, San Pablo and Gainesville, Florida.[10]]

1912. *B[elocephalus] subapterus* Karny, Genera Ins., Fasc. 139, Orth., Locustidae, Copiphorinae, p. 18, pl. 3 (color), fig. 10. [♀; Florida; south Georgia.]

1915. *Belocephalus subapterus* Davis, Jour. New York Ent. Soc., XXIII, p. 98, fig. 4. [♂; Gainesville, Florida.]

1915. *Belocephalus excavatus* Davis, Jour. New York. Ent. Soc., XXIII, p. 98, fig. 3. [♂; Gainesville, Florida.]

1916. *Belocephalus subapterus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 258. (In part.) [South Carolina, Georgia and northern Florida records, see discussion here under distribution.]

1920. *Belocephalus subapterus* Blatchley, Orth. of North-Eastern America, p. 503, fig. 166c, p. 507. (In part.) [Gainesville, Florida.[11]]

We here select as single type the female from northeastern Florida, belonging to the Museum of Comparative Zoology.[12]

[9] The references to this species by Redtenbacher and Karny in their monographs are of little value.

[10] The Miami and Chokoloskee records referred to, published by Rehn and Hebard in 1905, are now known to be incorrect, this species not reaching nearly so far south in its distribution.

[11] Figure 168 and the material from Sanford and Dunedin, Florida, represents *subapterus peninsularis* here described.

[12] This specimen is brown, with lateral apices of the subgenital plate short, the clypeal suture included in a black transverse bar. Its measurements are given on page 158.

The other specimen originally recorded, from "Florida," was collected by Wurdemann. It may not represent *subapterus*, but can not be placed safely without definite locality. It is brown, the latero-caudal apices of the subgenital plate are short and blunt, the fastigium is much as in *subapterus*, the antennae are spotted and there is a black transverse bar which includes the clypeus. Length of body 39, length of fastigium 2.8, length of pronotum 9.5, exposed length of tegmen 1.7, length of caudal femur 15.7, length of ovipositor 18.1 mm.

In that region, as is the case with many other species of Orthoptera, an optimum condition is developed, making it often more difficult than is usual to separate females from those of *davisi* Rehn and Hebard, the only other species occurring there. The slightly heavier build, more noticeable in the expansion of the face toward the jaws, and produced latero-caudal apices of the subgenital plate best serve to separate this sex of that species, which elsewhere averages decidedly larger than *subapterus*.

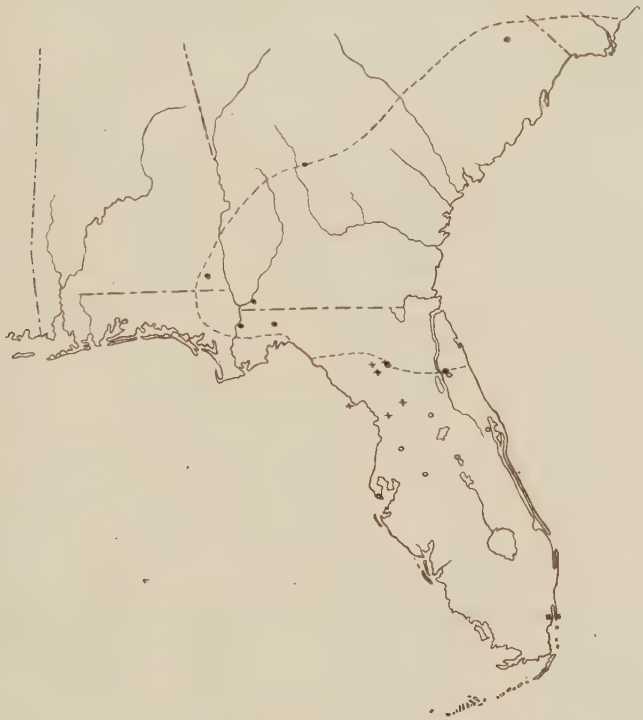


Fig. 1. Distribution of *Belocephalus subapterus subapterus* Scudder outlined approximately by series of dashes, with solid dots showing the known peripheral records. Localities at which *Belocephalus subapterus rehni* Davis has been taken indicated by +. Northernmost and southernmost localities for *Belocephalus subapterus peninsularis* subsp. n. indicated by circles. Localities at which *Belocephalus uncinatus* n. sp. has been taken indicated by squares.

Through the kindness of the authorities of the American Museum of Natural History, we have received for study the type of *excavatus* Davis. Shrinkage in drying of a teneral male has resulted in the softer (meso-distad) portion of the ultimate tergite caving in, with the natural accompaniment of a drawing in of the lateral apices. We have several such specimens in the series before us, but unfortunately, in Davis' individual, these differences are so asymmetrical that it is easy to see his reasons for believing that an undescribed species was represented. The specimen is otherwise typical of *subapterus subapterus* and *excavatus* is consequently a synonym.

In *subapterus* the fastigium is normally short for the genus, terminating in a slender decurved spine. Considerable individual variation occurs, however, rare individuals having it more elongate and very infrequently with spine straight, such individuals being indistinguishable in this feature from *davisi*.

Further individual variation is shown by material from Gainesville and Newberry, Florida, where intergradation with *subapterus rehni* plainly occurs. That race is distinguished by the fastigium which is rounded distad, lacking an apical spine. The intermediate material varies in having the fastigium shorter than usual with the normal spine, or with that spine greatly reduced or represented by a weak node. The majority from Gainesville are typical of *subapterous subapterus*, a few intermediate and very few typical of *subapterus rehni*. The majority from Newberry (type locality of *rehni*) are typical of *s. rehni*, many being intermediate to different degrees, but none wholly typical of *s. subapterus*.

The male ultimate tergite in *s. subapterus* is very broadly obtuse-angulate emarginate distad, the angulation sometimes slightly rounded. In Orange and Pascoe Counties southward the typical race is supplanted by the race *s. peninsularis* here described, in which this tergite is decidedly more produced disto-laterad, causing the emargination to be deeper, while its sides often show some convexity. This constitutes divergence toward the more deeply emarginate type of ultimate tergite found in *davisi* Rehn and Hebard and its allies. A few individ-

uals in a series from Pomona, Florida, are typical of *s. subapterus*, the majority showing divergence toward *s. peninsularis*. This is probably near the northern limit of the southern race, while *s. rehni* occurs due west of that locality.

In all the races of this species the antennae are heavily though finely spotted externally or annulate with blackish brown. The powerful jaws are also of this color, as is a broad transverse band which includes the clypeal suture. The tips of the spines of the fastigium, its dorsal margins narrowly and the lateral margins of the pronotal disk (often interrupted and sometimes only indicated cephalad) are blackish brown. The external surfaces of the limbs, particularly of the tibiae, are flecked with brown or blackish brown to varying degrees. A line of yellowish buff often margins the pronotal disk, just outside of the finer line of blackish brown, and is continued on the head and on the abdomen proximad in females, in the specimens where it is most strongly indicated. As in probably all the species of the genus, a green and a brown color phase is developed, the latter usually a rather light yellowish brown, sometimes decidedly more grayish and occasionally much darker.

Measurements (in millimeters)

♂	Length of body	Length of fastigium[18]	Length of pronotum	Exposed length of tegmen	Length of caudal femur
Florence, S. C.	25.3	1.9	6.9	7.8	14.7
Seven Mile, S. C.	22.8	1.9	6	7	12.1
Seven Mile, S. C.	27.2	2.2	7	7.8	14.3
Sandfly, Ga.	29.7	2.2	7.2	8.3	14.7
Claxton, Ga.	27	2.1	7.8	8.4	16
Smithville, Ga.	22.6	1.7	6.1	7.2	13
Smithville, Ga.	28	2.1	7.8	9.8	15.9
Billy's Island, Ga.	27.3	2.1	7.7	7.1	15.8
Thomasville, Ga.	24.5	1.6	6.3	7.7	12.7
Dothan, Ala.	22.3	1.3	6.7	7.1	13.1
Tallahassee, Fla.	28	2	7	7.7	14.6
Tallahassee, Fla.	28.8	2.2	7.8	7.9	16.5
Atlantic Beach, Fla.	32.3	2.3	7.8	6	16.1
Atlantic Beach, Fla.	36.1	3.2	8.3	6.7	18.8
Hastings, Fla.	30.7	2	7.3	6.8	14.9
Gainesville, Fla.	25.8	2.2	6.8	6.4	13
Gainesville, Fla.	28	2.1	7.8	8.2	16.3

[18] In this paper taken as from apex to tip of basal tooth.

♀	Length of body	Length of fastigium	Length of pronotum	Exposed length of tegmen	Length of caudal femur	Length of ovipositor
Seven Mile, S. C....	24.8	2	6.9	1.9	14.8	16.6
Seven Mile, S. C....	30	2.8	7.7	2.9	16.8	18.7
Sandfly, Ga.....	30.3	2.1	7	2	15.8	17.3
Isle of Hope, Ga....	33.2	2.5	7.9	2.7	17	18
Macon, Ga.....	26.8	2.1	7.5	2.2	17	18
Florida, *type*.....	28	2.2	6.9	1.7	15.7	18.1
Atlantic Beach, Fla..	35	3.4	8	2.4	18.1	19.5
Gainesville, Fla....	26	2.1	7	1.9	14.5	18
Gainesville, Fla....	35	2.3	7.9	2.5	17.3	20

In the western portion of this race's distribution (from as far east as Thomasville, Georgia, to Camp Torreya, Florida), a shortening of the fastigium, accompanied by a somewhat greater uncination of its apical tooth, is found. This may indicate further racial division, but it is incipient and not sufficient at the present time to warrant nominal recognition. It suggests *s. rehni* in a way, but the modification is different.

In northeastern Florida the greatest reduction in the male tegmina occurs.

The known limits of this race are Florence, South Carolina; Macon, Georgia and Dothan, Alabama, south to Pomona, Gainesville, and Tallahassee, Florida and Bainbridge, Georgia. Intermediates between it and *s. rehni* are known from Gainesville and Newberry, Florida, and it is found to vary toward *s. peninsularis* at Pomona, Florida.

The immature male recorded from Port Reed, Florida, by Scudder, in 1877, is before us and is found to represent *s. peninsularis*. The series from La Grange, Florida, recorded by Davis in 1914 is also at hand and likewise represents that race. Of the material studied by Rehn and Hebard in 1916, sixty three were correctly recorded, the specimens from Sanford, Orlando (and possibly Fort Drum), Florida, represent *s. peninsularis* and the female from Live Oak, Florida, *davisi*.

Specimens Examined, in addition to 55 previously correctly recorded: 240; 134 males, 60 females and 46 immature individuals.

South Carolina: Seven Mile, Charleston County, IX, 23, 1917, (Rehn and Hebard; occasional in rich tangled undergrowth of low lying pine woods), 14 ♂, 5 ♀, 3 juv. ♀, (2 ♂, 4 ♀ brown).

Georgia: Groveland, IX, 21, 1917, (Rehn and Hebard; rather numerous in one very small area of gallberry bushes in damp depression, one immature in saw palmetto in sandy low oak forest), 5 ♂, 1 ♀, 1 juv. ♀, (2 ♂, 1 ♀ brown). Claxton, IX, 22, 1923, (H. Fox), 1 ♂, (green), [Hebard Cln.]. Smithville, X, 20, 1923, (H. Fox), 2 ♂, (1 brown), [Hebard Cln.]. Macon, IX, 16 to 18, 1923, (H. Fox), 1 ♀, (brown), [Hebard Cln.]. Bainbridge, IX, 5 and 6, 1915, (Rehn and Hebard; on border of "branch" and in oak shoots in undergrowth of pine forest), 2 juv. ♂, 9 juv. ♀.

Alabama: Dothan, IX, 6 and 7, 1915, (Rehn and Hebard; in lush undergrowth of long-leaf pine forest, particularly in gallberry bushes), 6 ♂, 2 ♀, 2 juv. ♂, 10 juv. ♀, (1 ♀ brown).

Florida: Camp Torreya, Liberty County, X, 16, 1925, (T. H. Hubbell; in briars at night), 1 ♂, [Hubbell Cln.]. Tallahassee, IX, 2, 1915, (Rehn and Hebard; few in heavy swamp grasses and bushes), 2 ♂, 1 juv. ♂, 2 juv. ♀, (adults green). Woodville, Leon County, IX, 1, 1915, (Rehn and Hebard; occasional immatures in undergrowth of long-leaf pine forest), 3 juv. ♂, 2 juv. ♀. Pomona, Putnam County, IX, 7, 1917, (Rehn and Hebard; gallberry and bayberry bushes on sandy soil with oaks and pines, immatures occasional in high swamp grasses near lake), 9 ♂,[14] 3 ♀, 3 juv. ♂, 12 juv. ♀, (1 ♀ brown). Santa Fe, Alachua County, X, 18, 1911, (W. D. Appel), 1 ♀, [U. S. N. M.]. Gainesville, III, 13 to IX, 9, 1923 to 1925,[15] (Walker and Hubbell; many taken stridulating at night in grass and tangles of brush, usually two to six inches from ground), 88 ♂, 47 ♀,[16] (46 ♂, 40 ♀ brown), [Walker, Hubbell and Hebard Clns.]. Waldo, Alachua County, IX, 27 to X, 7, 1923 and 1924, (F. W. Walker), 1 ♂, 1 ♀, (green), [Hebard Cln.]. Payne's Prairie, Alachua County, XII, 7 and 14, 1924, (T. H. Hubbell; stridulating in tangle of grape vines, in brush and among tall weeds on edge of hammock and field), 4 ♂, (3 brown), [Hubbell Cln.].

[14] Pomona is in the area of intergradation with *s. peninsularis*. One male of this series is intermediate, five other males being referable to *s. peninsularis* and recorded under that geographic race. The females and immatures of these races are not distinguishable, but separation is possible from the locality alone over the territories in which each is known to occur typical.

[15] The great majority of this series were taken in October, November and December.

[16] Of this series 23 ♂ and 10 ♀ show varying degrees of divergence toward *s. rehni*, an additional 6 ♂ and 2 ♀ being nearly or quite typical of that race and recorded in the present paper under our discussion of it. No trace of a tendency toward *s. peninsularis* is shown.

We also have a male from Eustis, Florida, taken in November, 1923. This specimen has a somewhat deformed ultimate tergite, but is apparently referable to *s. subapterus*, though that locality may prove to be largely populated by *s. peninsularis*.

1a. **Belocephalus subapterus rehni** Davis (Pl. VIII, fig. 3.)

1912. *Belocephalus rehni* Davis, Jour. New York Ent. Soc., xx, p. 124. [♂, ♀; Newberry, Florida.]

1914. *B[elocephalus] rehni* Davis, Jour. New York Ent. Soc., xxii, p. 202, figure.

1920. *Belocephalus rehni* Blatchley, Orth. of North-Eastern America, p. 503, fig. 166e, p. 509. (In part.) [♂, ♀; Newberry, Ocala and Dunnellon, Florida.[17]]

This interesting race is distinguishable from typical *subapterus* only by the vertex, which averages decidedly shorter and either lacks an apical spine or shows a mere rudiment of such.

The material before us from Cedar Keys, Dunnellon and Ocala may all be said to be typical. Considerably over half that from Newberry shows a slight tendency toward typical *subapterus* in having a very small apical spine on the short fastigium, though in none is this spine sufficiently developed to consider the specimen intermediate. From Archer one immature male is *s. rehni*, the other nearly intermediate. In the very large Gainesville series the majority are typical *subapterus*, many atypical to varying degrees and only a small proportion referable to typical *rehni*. From this it is evident that Newberry, Archer and Gainesville are in the area of intergradation between these races; Newberry nearer the area occupied only by *s. rehni* and Gainesville nearer the area occupied only by *s. subapterus*.

All we know of the southern boundary of *rehni* is that it is located somewhere northwest of Orlando and north of Trilby. There is no evidence as yet as to whether it intergrades with *s. peninsularis*. Collecting material of the species in Hernando, Sumter, Lake and the southern portion of Marion Counties should, therefore, prove of considerable interest.

The coloration is as described for *s. subapterus*.

[17] The Orlando determination is almost certainly incorrect, that locality being well within the range of *s. peninsularis* here described.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Exposed length of tegmen	Length of caudal femur
Gainesville, Fla.	25	1.2	6.1	7.1	13
Gainesville, Fla.	29.8	1.8	7.7	7.1	16
Newberry, Fla.	24	1.1	6.7	7	13.2
Newberry, Fla.	28.5	1.9	7.1	7.2	16.4
Ocala, Fla.	23.8	1.3	6.7	5.9	13.5
Ocala, Fla.	31.8	1.9	8.5	7.9	18.4
Dunnellon, Fla.	26.3	1.6	7.4	7	16.2
Dunnellon, Fla.	27.8	1.7	7.8	7.7	15.9

♀	Length of body	Length of fastigium	Length of pronotum	Exposed length of tegmen	Length of caudal femur	Length of ovipositor
Gainesville, Fla.	21.9	1.9	6.9	1.3	14.6	18
Gainesville, Fla.	28.9	1.7	6.7	1.7	15	18.8
Newberry, Fla.	27	1.8	6.8	1.3	15.9	19.8
Newberry, Fla.	31.5	1.9	7.1	2.7	15.9	20
Cedar Keys, Fla.	27.2	1.4	7.7	2.8	16.9	18.5
Ocala, Fla.	30.8	1.9	8	1.7	18	21.1
Ocala, Fla.	31.1	1.7	7.8	2.1	17.9	22
Dunnellon, Fla.	26	1.6	7.8	1.9	17.1	19.8
Dunnellon, Fla.	31.8	1.7	8.8	2.3	19.3	21.8

The ovipositor in this race averages slightly more elongate than in *s. subapterus.*

Specimens Examined: 119; 69 males, 17 females and 33 immature individuals.

FLORIDA: Gainesville, IX, 9 to XI, 7, 1923 and 1924, (Walker and Hubbell), 6 ♂, 2 ♀, (3 ♂, 2 ♀ brown), [Walker, Hubbell and Hebard Clns.]. Newberry, VIII, 24 to X, 16, 1924, (F. W. Walker), 22 ♂, 10 ♀, 1 juv. ♂, 1 juv. ♀, (13 ♂, 8 ♀ brown), [Walker and Hebard Clns.]. Archer, Alachua County, VIII, 11, 1925, (T. H. Hubbell; sandy hillside), 2 juv. ♀, [Hubbell Cln.]. Cedar Keys, Levy County, X, 19, 1924, (T. H. Hubbell; in folds of tarpaulin), 1 ♀, [Hebard Cln.]. Ocala, IX, 19 and 20, 1917, (Rehn and Hebard; moderate numbers in areas of oak shoots in sandy pine woods, immature individuals quite numerous), 19 ♂, 4 ♀, 3 juv. ♂, 12 juv. ♀, (3 ♂, 3 ♀ brown). Dunnellon, IX, 19, 1917, (Rehn and Hebard; deforested rolling sandy country, taken from saw palmettoes, both in expanding fans and where the fully developed fans were touching; *D. davisi* also there in fewer numbers), 15 ♂, 7 ♀, 4 juv. ♂, 10 juv. ♀, (5 ♂, 7 ♀ brown).

1b. **Belocephalus subapterus peninsularis** new subspecies (Pl. VII, figs. 3 and 4; pl. VIII, fig. 4.)

1877. *Belocephalus subapterus* Scudder, Proc. Boston Soc. Nat. Hist., XIX, p. 83. [Juv. ♂; Fort Reed, Florida.[18]]

1914. *Belocephalus subapterus* Davis, Jour. New York Ent. Soc., XXII, p. 198. [♂, ♀; La Grange, Florida.[19]]

1916. *Belocephalus subapterus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 258. (In part.) [♀; Sanford and Orlando, Florida.[20]]

1916. *Belocephalus davisi* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 261. [♂,[21] ♀; Chuluota, Florida.]

1920. *Belocephalus subapterus* Blatchley, Orth. of North-Eastern America, p. 506, fig. 168. (In part.) [Sanford and Dunedin, Florida.[22]]

The average larger size (though probably exceeded by typical *subapterus* in the Jacksonville region, greater production of the male ultimate tergite and average slightly longer ovipositor, are the only features by which this race is separable from the more northern *subapterus subapterus* Scudder. The male ultimate tergite consequently shows divergence toward the type developed in *davisi* Rehn and Hebard and its allies.

Type.—♂; Lakeland, Florida. September 11, 1917. (Rehn and Hebard.) [Hebard Collection, Type no. 1041.]

Size medium for the genus, larger than the average in typical *subapterus*. Form normal: moderately robust, with short limbs. Fastigium produced, conical, with dorsal surface moderately flattened, in dorsal aspect with lateral margins subparallel

[18] This locality is now known to be well within the area covered by the present race and we therefore feel justified in placing here this immature male, now before us, plainly referable to the present species.

[19] We have been able to examine this series through the kindness of Mr. Davis.

[20] The female we recorded as *subapterus* from Fort Drum is apparently referable to this species, but without males from that region we are uncertain as to its racial status. It is a small specimen, with fastigium 2 mm. and ovipositor 18.8 mm. in length.

[21] The ultimate tergite is distorted in this male, due to preservation in liquid preservative. This in part accounts for our original erroneous assignment.

[22] Material typical of this race has recently been secured at Dunedin by Professor Blatchley and kindly forwarded for examination. Sanford is known to be within the area covered by the present race. As figure 168 is from a specimen of typical *peninsularis*, we are convinced that all of the material from those localities recorded in 1920 is so referable.

proximad for a distance approximating in length the distal portion, where they converge to the sharp, moderately decurved, apical spine; basal tooth of fastigium large and terminating evenly in a short, straight, heavy spine. Pronotum, short overlapping tegmina, cerci, subgenital plate and limbs as in *subapterus subapterus*. Abdomen with seven tergites weakly produced and subdenticulate meso-dorsad. Ultimate tergite with lateral portions so produced that two acute-angulate triangles are formed, their lateral margins parallel, their internal margins forming an angle slightly greater than a rightangle and with sides (usually) showing feeble convexity.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male in ambisexual characters. Size larger. Very similar to female of *subapterus subapterus* except in the average larger size and proportionately longer ovipositor. Tegmina represented by very small, rounded, lateral pads. Ovipositor elongate for the genus, moderately swollen proximad, very weakly curved dorsad throughout, unarmed, with apex acute. Subgenital plate large, embracing base of ovipositor laterad, distal margin broadly but deeply rounded-angulate emarginate, lateral margins straight and horizontal, thus the form of the lateral angles is sharply angulate at distinctly less than a rightangle, the apices themselves not reaching to near the dorsal margin of the ovipositor.[23]

General coloration light green or brown, the pronotum often showing a weak buffy line on each side, delimiting the disk from the lateral lobes. The following black markings occur. Antennae proximad with flecks on the external side of each segment except sometimes the first. Head with spines of vertex, very fine margins of antennal scrobes ventrad, mandibles and a broad transverse bar including the clypeal suture; vertex and very rarely occiput with a feeble lateral line on each side, continued on the pronotal disk more distinctly as a narrower internal margin of the lateral buffy lines. Cephalic limbs, median tibiae and caudal femora more weakly, finely and inconspicuously flecked. Abdomen in the green phase very rarely microscopically dotted, in the brown phase often beautifully longitudinally marked with different shades of brown, the darkest being a broad dorsal band and a line mesad on each side.

These features of coloration are the same in all the races of the species and are subject to individual variation through intensification or recession of the pattern.

[23] This affording one of the best features to separate the present species from *davisi*.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Exposed length of tegmen	Length of caudal femur	
Pomona, Fla.	26.5	2.1	6.8	6.4	14	
Pomona, Fla.	35.2	2.9	8.8	7.1	18.3	
Apopka, Fla.	34.5	2.3	8.5	8.3	17.8	
Clairecona, Fla.	31.9	2.3	8.2	7.9	17	
Orlando, Fla.	28.7	1.8	7.7	7.2	14.8	
Orlando, Fla.	34.8	2.8	8.6	8.2	17.5	
La Grange, Fla.	29.2	2.6	7	7.7	14.2	
La Grange, Fla.	35.8	2.8	8.2	7.4	16.2	
Kissimmee, Fla.	32.3	2.1	8	7.7	15.7	
Lakeland, Fla., *type*.	35.7	2.7	8.2	7	16.2	
Trilby, Fla.	28.7	2.1	7.8	7.9	16	
Hillsboro Co., Fla.	27.7	1.7	6.9	7.2	14.2	
Indian Beach, Fla.	29.8	2	8.1	8.2	15.9	
♀						Length of ovipositor
Sanford, Fla.	32.8	3	8	2.2	18.6	19.7
Apopka, Fla.	31.2	2.8	8	2.1	18.8	21.3
Orlando, Fla.	36	2.9	8	2.2	18.9	21.7
Orlando, Fla.	33	3	8	2.8	18.8	21.7
La Gange, Fla.	32.7	2.9	7.8	2.3	18	19.8
La Gange, Fla.	35.5	3	8	2.6	17.8	20.5
Lakeland, Fla., *allotype*	32	2.8	8.5	1.7	18.8	21.5
St. Petersburg, Fla.	32	2.3	7.8	2.3	17.3	19.8

The known northern limits of this peninsular Floridian race are Pomona, Lake Eustis and Trilby, while the southernmost records are La Grange, Kissimmee, Lakeland and St. Petersburg. We have little data on the genus in the regions adjacent to the southeastern and northwestern limits here given and this race may therefore reach some distance further in those areas.

At Indian Beach the following notes were made. "The song is very low and not rapid; rather similar to that of *Atlanticus gibbosus*, though lacking the series of whirring ticks, audible when very close to an individual of that species between its louder notes. These males continued to sing until approached closely and could be seized easily if reasonable caution were

exercised. Like *sabalis*, the few individuals which did not remain motionless upon ceasing their song, climbed about slowly, usually moving to the opposite side of their support when approached, and were captured with little difficulty. Their clinging strength is tremendous and unless seized with caution they can administer a painful bite."

Specimens Examined, in addition to 3 ♂, 7 ♀ and 1 juv., previously recorded as *subapterus:* 74; 22 males, 4 females and 48 immature individuals.

Florida: Pomona, Putnam County, IX, 7, 1917, (Rehn and Hebard; in gallberry and bayberry bushes on sandy soil, with oaks and pines), 5 ♂,[24] (all green). Lake Eustis, Lake County, 1 ♂, (green), [Hubbell Cln.]. Apopka, Orange County, IX, 17, 1924, (T. H. Hubbell; on palmetto in sand scrub), 1 ♂, 1 ♀, (♀ brown), [Hubbell and Hebard Clns.]. Clairona, Orange County, IX, 5, 1924, (F. W. Walker), 1 ♂, 1 large juv. ♀, [Walker and Hebard Clns.]. Orlando, Orange County, VII, 23 to X, 4, 1924, (F. W. Walker), 5 ♂, 1 ♀, 2 juv. ♀, (2 ♂ brown), [Walker and Hebard Clns.]. Kissimmee, Osceola County, IX, 9 and 10, 1917, (Rehn and Hebard; beaten from undergrowth in Cypress bay and juv. in grasses on sandy soil), 1 ♂, 3 juv. ♂, 3 juv. ♀, (all green). Lakeland, Polk County, IX, 11, 1917, (Rehn and Hebard), 1 ♂, 1 ♀, *type* and *allotype*, 4 juv. ♂, 4 juv. ♀, (all green). Trilby, Pasco County, IX, 16, 1917, (Rehn and Hebard; undergrowth of pine woods, in oak shoots but particularly in gallberry bushes), 2 ♂, *paratypes*, 12 juv. ♂, 16 juv. ♀, (8 juv. brown). Indian Beach, Sand Key, Pinellas County, IX, 17, 1917, (Hebard; adults stridulating in low vines and plants at night), 3 ♂, 3 juv. (all green). Dunedin, I, 1, 1926, (W. S. Blatchley), 1 ♂, [Blatchley Cln.]. St. Petersburg, Pinellas County, IX, 1917, 1 ♀ [Davis Cln.]. Hillsboro County, XII, 24, 1923, (A. R. Johnson), 1 ♂, [Hubbell Cln.].

2. **Belocephalus uncinatus** new species (Pl. VII, fig. 5; pl. VIII, figs. 5 and 6.)

This insect is known only from the cabbage palmettoes at Miami Beach and from Miami, Florida. It is the only small species with simple male subgenital plate and annulate antennae known from the subtropical zone of Florida. It resembles typical *subapterus* but has the apical spine of the vertex more strongly decurved than is usual in any other species,[25] the male ultimate tergite of the type developed in *sleighti* Davis but with

[24] See material also recorded under typical *subapterus*.

[25] Though no more so than in individuals of typical *subapterus* and *subapterus peninsularis* showing maximum decurvature of this spine.

lateral productions shorter and their internal margins even more strongly convex distad, the male cerci with ventral arm unusually narrow at its base and the male subgenital plate of the same type found in *sabalis* Davis but much wider distad between the styles.

The single female before us closely resembles individuals of that sex intermediate between *subapterus subapterus* and *subapterus rehni*, the vertex being shorter and blunter, with apical tooth more decurved than in the former race.

Type.—♂; Miami Beach, Florida. February 17, 1922. (M. Hebard.) [Hebard Collection, Type no. 1043.]

Size small for the genus; form moderately robust, much as in *hesperus* here described. Fastigium of the usual produced conical type, but short for the genus, with lateral margins subparallel a distance exceeding in length the distal portion, where they converge to the sharp, short and decidedly decurved spine. Pronotum, short overlapping tegmina and limbs much as in *subapterus*. Abdomen with seven tergites weakly produced and subdenticulate meso-dorsad. Ultimate tergite with lateral portions so produced that only a deep U-emargination remains, their external margins straight and very feebly convergent, their internal margins very strongly convex particularly distad, so that each produced portion is only slightly narrower distad than proximad, its length approximating its basal width. Cerci quite similar to those of *subapterus* but with claws slightly more elongate and ventral arm narrower at its base. Subgenital plate more ample, the lateral margins oblique convergent to the apical, socketed styles, the interval between which is decidedly broader, evenly and broadly concave. Styles small, cylindrical, tapering, about three times as long as proximal width.

Allotype.—♀; Miami, Dade County, Florida. (Mrs. Annie Trumbull Slosson.) [Hebard Collection.]

Agrees closely with male in ambisexual features, except that the fastigium is shorter and blunter. Very similar to this sex of *subapterus peninsularis* in other features as described on page 163, except that the lateral apices of the subgenital plate are somewhat less produced.

Coloration as in *subapterus*, described on page 157, except that the basal tooth of the vertex is more heavily suffused with black, this sometimes extending as a ventral, medio-longitudinal suffused line to the black apical tooth.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Exposed length of tegmen	Length of caudal femur
Miami Beach, Fla., *type* ..	29.2	1.7	8	7	15.2
Miami Beach, Fla., *paratype*	27	1.8	7.5	7.3	14.8
Miami Beach, Fla., *paratype*	31.5	1.8	8.7	7.3	16.3
Miami Beach, Fla., *paratype*	30.3	1.7	9.1	7.9	17
♀					
Miami, Fla., *allotype*	31.8	1.8	7.8	1.8	21.3

The males were all secured on a warm windy evening with the aid of an electric hand torch. They were stridulating vigorously, in the cabbage palmettoes at two different localities and were easily located and secured. The majority were six to eight feet from the ground, but others were heard in the upper fans as much as eight feet higher.

Specimens Examined: 9; 8 males and 1 female.

FLORIDA: Miami Beach, II, 17, 1922, (Hebard), 8 ♂, *type* and *paratypes*. Miami, (Mrs. A. T. Slosson), 1 ♀, *allotype*.

3. **Belocephalus hesperus** new species (Pl. VII, figs. 6 and 7; pl. VIII, fig. 7.)

This interesting little insect occupies the extreme western limit of the distribution of the genus.

It is closely allied to *davisi* Rehn and Hebard. The male ultimate tergite and cerci and female ovipositor and subgenital plate indicate this relationship. The small size and short vertex with decurved apical spine agree, however, more nearly with *subapterus* Scudder. The present insect is very slightly more robust and compactly built than either of those species.

Type.—♂; St. Elmo, Mobile County, Alabama. August 26, 1915. (Rehn and Hebard.) [Hebard Collection, Type No. 1042.]

Size small for the genus. Form slightly more robust than usual. Fastigium of the usual produced conical type, but short for the genus, with apical spine rather strongly decurved. Face slightly more inflated than in the allied species. Pronotum, very short overlapping tegmina, subgenital plate and limbs as in *subapterus*. Abdomen with seven tergites showing a very faint trace of the meso-dorasal production found in that species. Ultimate tergite much as in *davisi*, with lateral portions so produced that two acute-angulate angles with rounded apices are formed, their lateral margins moderately convergent, their internal margins forming a rounded rectangulate emargination (or less). Cerci much as in *davisi*, the two incurved claws of each with decurved apices proportionately longer, the interval between the bases of these evenly concave,[26] the external surface at the base of the ventral claw showing distinct impression. Subgenital plate with lateral margins evenly convergent to the broadly rounded lateral apices, between which the distal margin is broadly rounded obtuse-angulate concave. Beneath each of the lateral apices is a small, straight, cylindrical style, about three times as long as broad, with apex rounded.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male in ambisexual features. Size much the same. The short fastigium with decurved apex and small size along serve to separate it from this sex of *davisi*. Tegmina as in that species. Ovipositor short for the genus, decidedly swollen proximad for a greater distance than in *subapterus*, very weakly curved dorsad, this as marked as in *subapterus* only distad. Subgenital plate as in *davisi;* large, embracing base of ovipositor laterad, distal margin broadly and deeply rounded angulate emarginate, lateral margins very weakly concave, lateral apices produced, filiform, reaching nearly the dorsal margin of the ovipositor if this plate is not bent down.

Color as described for *subapterus peninsularis* on page 163, except that the buffy lateral longitudinal bands on head and pronotum are usually broader and more conspicuous and the dark markings are more produced, the suffused transverse bar which includes the clypeal suture being blackish brown, much less heavy and very weak on each side above the mandibles. In these color differences closer agreement with *davisi* is again shown. All of the present series are of the green color phase.

[26] In *subapterus* this interval is flattened, with a trace of angulation on each side, instead of curving evenly into the internal margins of the claws.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Exposed length of tegmen	Length of caudal femur	
Tifton, Ga.	23	1.7	6.9	7.7	13.9	
Tifton, Ga.	29.7	2	7.8	6.7	15.8	
Carrabelle, Fla., *paratype*	30.3	2.1	7.1	4.9	14.2	
St. Elmo, Ala., *type*	30.8	1.9	7.7	5.2	14.7	
♀						Length of ovipositor
Irvington, Ala., *paratype*	27.8	1.9	6.7	2	15.9	16.4
Irvington, Ala., *paratype*	29	1.9	6.9	2	16	16.3
St. Elmo, Ala., *allotype*	29	2	6.9	2	15.8	17.7
St. Elmo, Ala., *paratype*	28.8	1.9	7.2	1.8	16.1	16.9
St. Elmo, Ala., *paratype*	31.2	2.1	7.1	2.1	17	15.9

The Carrabelle male agrees closely with the type. Those from Tifton are aberrant in having a distinctly though very slightly less robust build and longer tegmina, consequently showing a very close general resemblance to *subapterus*. The male ultimate tergite and cerci, are, however, typical of *hesperus*.

Specimens Examined: 23; 4 males, 5 females and 14 immature individuals.

Georgia: Tifton, Tift County, IX, 3, 1915, (T. H. Hubbell), 2 ♂, 1 juv. ♂, [Hubbell and Hebard Clns.].

Florida: Carrabelle, Franklin County, IX, 3, 1915, (Rehn; in marshy grasses and plants on edge of swamp area), 1 ♂, *paratype*. Big Bayou, Pensacola, VIII, 25, 1915, (Rehn and Hebard; in rich vegetation bordering hammock in long-leaf pine woods), 3 juv. ♂, 2 juv. ♀.

Alabama: Mobile, VIII, 26, 1915, (Hebard; in grasses of a deforested area), 1 juv. ♂. Springhill, Mobile County, VIII, 25, 1915, (Rehn and Hebard), 3 juv. ♀. Irvington, Mobile County, VIII, 26, 1915, (Rehn; in grasses of somewhat swampy deforested flatwoods), 2 ♀, *paratypes*. St. Elmo, Mobile County, VIII, 26, 1915, (Rehn and Hebard; in short grasses of long-leaf pine flatwoods), 1 ♂, 3 ♀, *type, allotype, paratype*, 2 juv. ♂, 1 juv. ♀.

4. **Belocephalus davisi** Rehn and Hebard (Pl. VII, fig. 9; pl. VIII, figs. 8 and 9.)

1916. *Belocephalus subapterus* Rehn and Hebard, (in part, not of Scudder, 1875), Proc. Acad. Nat. Sci. Phila., 1916, p. 258. [♀; Live Oak, Florida.]
1916. *Belocephalus davisi* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 259. [♂, ♀; Billy's Island in Okeefenokee Swamp, Georgia.[27]]
1920. *Belocephalus subapterus davisi* Blatchley, Orth. of North-Eastern America, p. 507. (No additional material.)

This species represents a type in some ways annectant between *subapterus* Scudder and *sabalis* Davis. It is not, however, a geographic race of the former, as Blatchley indicated, since its distribution is coextensive with that of that species, but much more limited and local.

Compared with *subapterus*, we find it to differ in having the size averaging considerably larger, the male ultimate tergite even more deeply emarginate than in the race *subapterus peninsularis* (with which it is more likely to be confused), the ovipositor heavier proximad and shorter and female subgenital plate with lateral apices much more elongate, filiform.

The more western *hesperus*, here described, shows very close relationship but represents, we believe, a valid species, distinguished by the smaller size, slightly more robust form and short fastigium with more uncinate apical spine.

Compared with the southern *sabalis* the present species is seen to average smaller in size, with shorter fastigium and less deeply cleft male subgenital plate. The antennae are also usually immaculate in that species, but in the northeastern portion of its range they are quite as heavily marked as is usual in *davisi*.

We find *davisi* sufficiently plastic to make determination of material sometimes difficult. The known distribution reaches north to Billy's Island, Georgia and Live Oak, Florida, and south to St. Augustine and Dunnellon in the latter state. It should be noted that the species, with which confusion might occur, are found either west or south of the territory in which it is found.

The coloration is subject to considerable variation; often as here described for *subapterus peninsularis* on page 163, but sometimes as described for *hesperus* on page 168.

[27] The pair from Chuluota, Florida, recorded at that time, we find referable to *subapterus peninsularis*.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Length of tegmen	Length of caudal femur	
Billy's Island, Ga., *type*	34	2.8	8.2	6	16	
Billy's Island, Ga., *paratype*	41	3.2	9	6	18.1	
Columbia Co., Fla.	40.5	3.9	9.3	6.8	18.8	
Waldo, Fla.	32.5	3.1	8.5	6.2	17	
Waldo, Fla.	37.6	3.7	9.3	6.8	18.8	
Newberry, Fla.	29.5	2.2	8.2	6.9	17.5	
Newberry, Fla.	37.7	2.3	8.2	7.9	17.2	
Levy County, Fla.	38	3.6	8.9	6.3	17.3	
Dunnellon, Fla.	37	3.4	9.8	6.8	18.5	
Dunnellon, Fla.	38.2	3.4	9.8	6.8	19.3	
♀						Length of ovipositor
Billy's Island, Ga., *allotype*	36	3.4	8.2	2.4	18.2	18.2
Live Oak, Fla.	37.8	3.8	8.4	2	18.9	20.8
St. Augustine, Fla.	34.2	3	7.8	2.7	16.9	17.8
Waldo, Fla.	36.8	3.9	8.2	1.9	18.8	19.7
Newberry, Fla.	33.7	2.7	7.8	2.8	17.9	20
Newberry, Fla.	37.8	2.8	8.2	2.7	18.7	21
Dunnellon, Fla.	38.5	3.7	9.1	3.1	19.2	21
Dunnellon, Fla.	41	3.8	8.8	2.8	19.3	18.5

This insect is evidently much more local in distribution than *subapterus*, with which species alone its distribution is coëxtensive. Its considerably larger average size will readily distinguish it except in the Jacksonville region, where *subapterus* is found equally large. The longer fastigium normally separates *davisi* quite as well from that species, but in the entire Newberry series it is no longer than its optimum development in *subapterus*. This is of interest, as at that locality *subapterus rehni* Davis occurs, a race characterized by the shorter, blunt fastigium. Here the analogy ceases, however, as our Gainesville and Dunnellon material shows no such fastigial reduction, though *subapterus rehni* is found at the former locality and wholly supplants typical *subapterus* at the latter.

The degree of uncination of the apical spine of the vertex is subject to some variation. Normally elongate and very faintly

decurved, in the Billy's Island and Newberry series it shows an average slightly greater decurvature, closely resembling the normal for *subapterus peninsularis*. Such variation prevents use of what would at first appear to be an excellent feature to separate this species from *subapterus*, without qualification. The form of the male ultimate tergite, short ovipositor and different female subgenital plate, remain as the best features for separation from that species; *hesperus* being more compact, smaller and with apical spine of vertex decidedly decurved.

At Dunnellon we found this species in the same area of saw palmetto as *subapterus rehni*, but much scarcer. During the day individuals of these species were hidden in these plants both in the expanding central fans and where the fully developed fans, either alive or dead, overlapped in such a way that a place of concealment was formed. Hubbell states that the song is a rapid series of not very loud "zips," in his Newberry notes.

Specimens Examined, in addition to 5 males and 1 female of the originally described series, including the type and allotype: 68; 43 males, 15 females and 10 immature individuals.

FLORIDA: Suwannee River, Columbia County, XII, 3, 1923, (T. H. Hubbell), 1 ♂, (green), [Hebard Cln.]. Live Oak, Suwannee County, VIII, 26, 1911, (Rehn and Hebard; in small clump of ground oak, beside sink-hole), 1 ♀, (green). Anastasia Island, St. Augustine, XII, 9, 1923, (T. H. Hubbell), 1 ♀, (brown), [Hubbell Cln.]. Gainesville, VII, 18 and 19 and VIII, 8, 1925, (T. H. Hubbell; flatwoods adjacent to cypress swamp and pond on Waldo road), 5 juv. ♂, 5 juv. ♀. Waldo, Alachua County, IX, 27, 1924, (T. H. Hubbell; margins of cypress ponds at night), 4 ♂, 1 ♀, (pair brown), [Hubbell and Hebard Clns.]. Fairbanks, Alachua County, VIII, 5, 1924, (F. W. Walker; cypress swamp), 3 ♂, (green), [Walker Cln.]. Newberry, Alachua County, VIII, 3 to 12, 1924 and 1925, (Hubbell and Walker; in clumps of rather high palmetto on high pine land, at night), 19 ♂, 8 ♀, (9 ♂, 7 ♀ brown), [Hubbell, Walker and Hebard Clns.]. Wacassassee River, Levy County, IX, 29 and 30, 1923, (Walker and Hubbell; marginal zone of cypress swamp and in palmetto and gallberry of flatwoods), 3 ♂, [Acad. Nat. Sci. Phila. and Hubbell Clns.]. Dunnellon, Marion County, IX, 18 and 19, 1917, (Rehn and Hebard; ten in saw palmetto on rolling sandy deforested country, others in saw palmetto on edge of swamp; long search revealed few in higher region), 13 ♂, 4 ♀, (6 ♂, 1 ♀ brown).

5. **Belocephalus sabalis** Davis (Pl. VII, fig. 10; pl. VIII, figs. 10 and 11.)

1905. *Belocephalus subapterus* Rehn and Hebard, (not of Scudder 1875), Proc. Acad. Nat. Sci. Phila., 1905, p. 44. [♀; Miami and Chokoloskee, Florida.]

1912. *Belocephalus sabalis* Davis, Jour. New York Ent. Soc., XX, p. 123. [♂; Punta Gorda, Florida.]

1914. *Belocephalus sabalis* Davis, Jour. New York Ent. Soc., XXII, p. 199. [♂; Miami and Cocoanut Grove, Florida.]

1915. *Belocephalus sabalis* Hebard, Ent. News, XXVI, p. 458. [♀, juv. ♂; Cocoanut Grove and Miami, Florida.]

1916. *Belocephalus sabalis* Hebard, Ent. News, XXVII, p. 20. [juvs.; Pineland, Pine Island, Lee County, Florida.]

1920. *Belocephalus sabalis* Blatchley, Orth. of North-Eastern America, p. 504, figs. 166a and 167. [♂, ♀; Parish and Fort Myers, Florida.]

For this insect and its near allies we recognize the Sabalis Group, including large species, with immaculate antennae (except for *sabalis* in the northeastern portion of its distribution) and elongate fastigium, with terminal spine straight or nearly so. The males have the ultimate tergite variously produced but always deeply cleft, the cerci with proximal portion of the lower claw broad and its caudal surface there well impressed and the subgenital plate simple, with style sockets slightly more inset than in the other species of the genus.

Fig. 2. Localities at which *Belocephalus sabalis* Davis has been taken, indcated by solid dots, those for *Belocephalus sleighti sleighti* Davis by + and those for *Belocephalus sleighti simplex* subsp. n. by ×.

Restricted to southern and central peninsular Florida, *sabalis* has been found almost always on the coast, the most inland record being that of a single male from Orlando. Though West Coast material shows some individual variations, this is by no means as pronounced as in series from the East Coast before us. Further material from numerous other localities may show the presence of one or more recognizable geographic races, but from the available material it appears advisable to attribute the differences noted to individual variation or at most incipient racial differentiation, insufficient to warrant nominal recognition.

The western typical condition may be characterized as follows. Size large. Form robust. Fastigium elongate with tapering distal portion much longer than the proximal portion and apical spine feebly decurved, this curvature extremely weak in some females. Distal portion of abdomen slightly but distinctly widened in the males, the ultimate tergite with lateral acute-angulate portions produced, their internal margins convex to different degrees and occasionally straight,[28] the emargination so formed deep, usually rounded at its base and forming an angulation distinctly less than a rightangle, very rarely rectangulate. Styles flattened, slightly over twice as long as broad. Females differ from that sex of *davisi* in the larger size, average more elongate fastigium and proportionately shorter ovipositor, which shows weak though appreciably greater curvature dorsad.

The eastern material from Miami and Ft. Lauderdale shows nearest agreement. The fastigium, however, averages heavier and shorter, while a trace of fine external spots is shown on the antennae in one brown female.

The Ft. Pierce males have an average more elongate and evenly tapering fastigium than typical *sabalis*, but the ultimate tergite is broader in the males, with lateral projections sharply acute angulate. In one, a trace of fine external spots is shown on the antennae, this being stronger, weak but distinct, in the other two.

The La Grange and New Smyrna specimens have the fastigium evenly tapering but the antennae very heavily spotted with black, and the single male has the ultimate tergite no wider than in typical *sabalis*, the internal margins of the lateral pro-

[28] The material before us shows plainly this variation, a feature used by Davis to separate the species from his *sleighti*.

ductions convex. A male from Orlando agrees with this male except in having the ultimate tergite narrower.

All of the East Coast females have the ovipositor distinctly shorter than those from the West Coast.

Such differences as those noted above give certain individuals a very distinct appearance, but comparison of the series apparently indicates that not even racial differentiation can be recognized.

The color is subject to considerable variation, much as described for *subapterus peninsularis*, except that the antennae are usually immaculate.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Length of tegmen	Length of caudal femur	
New Smyrna, Fla. . .	38.5	4.2	9.4	7.2	18.8	
Orlando, Fla.	37.2	3.7	8.8	7.8	17.4	
Ft. Pierce, Fla.	36.2	3.7	8.3	6.7	16.3	
Ft. Pierce, Fla.	43	3.8	10	7.2	19.2	
Ft. Lauderdale, Fla.	39.5	2.9	9	7.5	18.3	
Ft. Lauderdale, Fla.	44	3.8	10.1	6.8	22	
Miami, Fla.	43.4	3.1	9.8	5.8	20.1	
Indian Beach, Fla. . .	38.5	3.8	9.2	6.8	18	
Indian Beach, Fla. . .	43	4.2	10.7	7.9	21	
Manatee, Fla.	39.7	3.2	9.2	6.8	18.7	
Manatee, Fla.	48.5	4.3	10.8	7.2	20.2	
Parish, Fla.	42.7	3.8	10	7.7	20	
Parish, Fla.	44.2	4.2	10.7	7.1	20.8	
Useppa Island, Fla. .	39.4	3.1	9.3	7.8	17.7	
Useppa Island, Fla...	42.5	3.6	10.2	7.1	20.7	
Punta Gorda, Fla., *paratype*	38.8	3.4	9.3	7.2	18	
Punta Gorda, Fla., *paratype*	43.3	3.2	9.8	7.2	19.8	
♀						Length of ovipositor
New Smyrna, Fla. . .	40.6	4.4	9.1	3	20.3	17.8
New Smyrna, Fla....	41.5	4.5	9	3.4	20.1	17.8
La Grange, Fla.	40	4.2	9.7	2.7	20.7	17.7
Dade County, Fla. . .	39.4	3.3	10	2.3	20.8	16.7
Manatee, Fla.	42.3	4.2	9.4	2	20.6	19
Manatee, Fla.	47	4	9.8	2.7	20	19
Manatee, Fla.	45.6	4.8	10	2.1	22	20.1
Parish, Fla.	42.5	4.2	9.2	2.7	19.8	19.7

At Indian Beach the author found this insect moderately numerous in clumps of cabbage palmetto, in isolated tops of

the same, in vines and in bushes and particularly in young saw palmettoes. Compared with *hebardi* (which had been heard shortly before) we noted that "the song is very much louder and exceedingly rapid, in fact almost too rapid to count. Counting up to eight, seven or eight times in ten seconds, gave five and a half to six and a half notes per second. The sound is an incessant dzee-dzee-dzee-dzee-dzee, suggestive of the song of *Pyrgocorypha uncinata*, though decidedly less loud and lacking the distinctive ringing machine-like quality. Our observations were made on a warm night, and as Hubbell has noted about the first of the year that the song was slow, it is probable that the speed varies with the temperature, as is known to be true for the tree-cricket, *Oecanthus niveus*.

We have noted, from an immature individual in captivity, how strictly nocturnal is the species. That specimen "rested rigid in some concealed position during the day, with cephalic limbs and antennae directed straight forward and median and caudal limbs straight backward, but at night moved actively about and was extremely alert and rapid."

Specimens Examined, in addition to 3 ♂ *paratypes* and 12 previously recorded individuals: 71; 55 males, 14 females and 2 immature individuals.

FLORIDA: New Smyrna, Volusia County, X, 18, 1920, (B. L. Boyden; on sugar cane), 1 ♂, 2 ♀, (all brown), [U. S. N. M. and Hebard Cln.]. Orlando, Orange County, IX, 7, 1924, (F. W. Walker), 1 ♂, (green), [Hebard Cln.]. Ft. Pierce, St. Lucie County, II, 14, 1919, (Hebard; moderately large colony, in cabbage palmetto, undergrowth and vines, on shore of Indian River, from close to ground to high in palmettoes; song not loud, individuals extremely alert, ceasing song abruptly when approached), 3 ♂, (1 green). Ft. Lauderdale, Broward County, IX, 2 to 4, 1925, (T. H. Hubbell; song not loud but penetrating), 6 ♂, (3 brown), [Hubbell and Hebard Clns.]. Dade County, 1 ♀, (brown), [U. S. N. M.]. Indian Beach, Sand Key, Pinellas County, IX, 17, 1917, (Hebard; singing at night, taken with aid of flash lamp), 15 ♂, (2 brown). Parish, Manatee County, X, 17 and 22, 1916, 3 ♂, 1 ♀, (1 ♂ green), [Davis and Hebard Clns.]. Manatee, Manatee County, VIII, 18 to 24, 1925, (T. H. Hubbell; many high in foliage of cabbage palmettoes, one in weeds; song rapid, staccato, not loud, zik-zik-zik-zik-zik), 19 ♂, 9 ♀, 2 large juv. ♀, (1 ♂, 3 ♀ brown); XII, 31, 1924 and I, 1, 1925, (T. H. Hubbell; in low shrub in open, on branch of mango tree, in dry rolled up banana leaf and singing in tall grass; song loud and slow, like that of *Neoconocephalus ensiger* but slower and lower pitched zip-zip-zip-zip-zip) 4 ♂, 1 ♀, (2 ♂ green), [Hubbell and Hebard Clns.]. Oneco, Manatee County, I, 2,, 1925, (T. H. Hubbell; in tall grass of low, wet, brushy area), 1 ♂, (green), [Hubbell Cln.]. Useppa Island, Lee County, V, 17, 1919, (Hebard; stridulating vigorously at night in tops of cabbage palmettoes), 2 ♂, (1 brown).

6. **Belocephalus sleighti sleighti** Davis (Pl. VIII, figs. 12 and 13).

1914. (June.) *Belocephalus sabalis* Rehn and Hebard, (not of Davis, 1914), Proc. Acad. Nat. Sci. Phila., 1914, p. 401. [♂; Marathon, Key Vaca, Florida.]

1914. (September.) *Belocephalus sleighti* Davis, Jour. New York Ent. Soc., XXII, p. 199. [♂, ♀; Big Pine Key, Florida.]

1920. *Belocephalus sabalis sleighti* Blatchley, Orth. of North-Eastern America, p. 506, fig. 166b. (No additional material.)

This insect, very close to *sabalis* Davis, is best separated by the shorter fastigium, slightly more swollen face below the eyes which consequently gives the head a less evenly tapering outline, and in the typical race the male with ultimate tergite slightly more deeply emarginate, the inner margins of the lateral productions showing average convexity. In this insect the apex of the abdomen is never wider than the proximal portions.

Were it not for the fact that we find no convergence between *sabalis* at Miami and *sleighti simplex*, here described, at Homestead, it would have appeared very probable that this insect represented a geographic race of *sabalis*.

In coloration the similarity to *sabalis* is very close, this insect differing only in having the brown suffused band which includes the clypeal suture very weakly indicated in one and subobsolete or entirely absent in four other males before us. All of these specimens are green, but a brown phase undoubtedly occurs, probably very similar to that described under *sleighti simplex*.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Length of tegmen	Length of caudal femur
Marathon, Key Vaca, Fla.	45	2.8	10.1	8	19.5
Big Pine Key, Fla., *paratype*	38.7	2.7	9.8	7	17.9
Big Pine Key, Fla., *paratype*	40.1	2.4	9.8	5.8	17.8
Big Pine Key, Fla., *paratype*	40	2.6	10.4	7.8	19.3
Big Pine Key, Fla., *paratype*	41.1	2.5	10.3	7	18.2
♀					
Big Pine Key, Fla., *paratype*[29]	42	3[30]	10.5	3	20

[29] From Davis.

[30] Length of fastigium beyond base of antenna. This slightly exceeds its length from basal tooth to apex, as given by us.

Specimens Examined, in addition to 4 paratypic males: 1, 1 male.

FLORIDA: Marathon, Key Vaca, VII, 9. 1912, (Hebard; stridulating on vine tangle at night), 1 ♂, (green).

6a. **Belocephalus sleighti simplex** new subspecies (Pl. VII, figs. 11, 12 and 13; pl. VIII, figs. 14 and 15.)

1914. *Belocephalus sabalis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1914, p. 401. [♂; Homestead, Florida.]

We propose this name for a geographic race of the species, found on the mainland of peninsular Florida, at its extreme southeastern point. It is very close to typical *sleighti* of the Florida Keys, differing in the average smaller size, more graceful form, average shorter fastigium and male ultimate tergite not as deeply cleft.

Compared with *sabalis* Davis it is found to differ in the average considerably shorter fastigium, slightly more swollen face below the eyes which consequently gives the head a less evenly tapering outline, average smaller size and more graceful form. Like in the typical race, the male abdomen is never broader distad than proximad.

Type.—♂; Homestead, Dade County, Florida. July 10 to 12, 1912. (Rehn and Hebard.) [Hebard Collection, Type No. 1044.]

Size smallest of the large species of the genus, form more evenly cylindrical. Fastigium small, with very small apical tooth (usually) decidedly decurved. Pronotum, comparatively short tegmina, limbs, cerci and subgenital plate as in *sabalis* and typical *sleighti*. Dorsal surface of abdomen with only a trace of a medio-longitudinal, interrupted, carina. Ultimate tergite much as in *sabalis*, median cleft not as deep as in typical *sleighti*, internal margins of lateral productions convex (but often appearing straight, due partially to individual variation and partially to having been drawn in and downward in drying).

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Length of tegmen	Length of caudal femur
Homestead, Fla., *type*	34.2	1.9	8.6	5.2	15.9
Homestead, Fla., *paratype*	35	1.9	8.8	5.7	16.3
Homestead, Fla., *paratype*	39	2.2	9.1	7	18.1
Homestead, Fla., *paratype*	39.4	2.1	9.7	6.3	17.5
Homestead, Fla., *paratype*	40.8	2.1	8.8	6.8	17.1
Florida City, Fla.	37	2.1	9.5	6.1	16.8

The majority of the present series are green and immaculate, a few showing weakly the buffy pronotal bands dorso-laterad and very few with traces of dark markings. The mere tips of the spines of the vertex and the mandibles are blackish brown, the clypeal suture usually immaculate, rarely with a very faint suffusion of brown. Eight are of a brown color phase, of a rather light shade, but in these the darker brown dots on the external surface of the antennae are present, though by no means as prominent as in *subapterus* or the northeastern specimens of *sabalis*.

At the type locality we noted that the majority were on low saw palmetto in the pine woods, others being found on sugar cane, in a low bush and on the trunk of a pine tree. They were secured by stalking with a flash-lamp at night and proved to be alert, ceasing their low "zip-zip-zip-zip-zip" often at a distance of twenty feet. Capture was, however, easy, as rarely an attempt was made by these insects to escape; an individual, upon close approach, merely slipping down the palmetto fan a few inches or around to the other side, there flattening out with caudal limbs extending backward and cephalic limbs forward. These curious Copiphorids are able to inflict a painful bite with their powerful jaws.

Specimens Examined: 30; 30 males.

FLORIDA: Homestead, Dade County, VII, 10 to 12, 1912, (Rehn and Hebard), 28 ♂, *type* and *paratypes*, (7 brown). Florida City, Dade County, III, 13, 1920, (Hebard; secured when half grown on silver palm (*Coccothrinax argentea* Lodd), bred adult on cabbage, end of May and June 3), 2 ♂, (1 brown; both were green, one changing to the brown color phase in the next to last moult).

7. **Belocephalus hebardi hebardi** Davis (Pl. VII, fig. 14; pl. VIII, fig. 16.)

1912. *Belocephalus hebardi* Davis, Jour. New York Ent. Soc., xx, p. 123. (♂, ♀; Punta Gorda, Florida.]

1920. *Belocephalus subapterus hebardi* Blatchley, Orth. of North-Eastern America, p. 508. [Fort Myers, Florida.]

This species shows nearest resemblance to *subapterus peninsularis* here described, of the preceeding forms. It differs in the slightly more slender apex of the fastigium at the base of the decurved apical spine, the much more decurved ventral arm of the male cerci, the bidentate and differently emarginate male subgenital plate and the longer, straighter ovipositor.

It forms a clearly defined group, including *hebardi proximus* here described and *micanopy* Davis, all of which agree in the features of the male ultimate tergite, cerci, specialized subgenital plate and of the female ovipositor. Under *micanopy*, comparison with *hebardi* is made.

It is unfortunate that similarity in many other less significant features led Blatchley to place this insect as a race of *subapterus*, a species belonging to a very distinct group.

The species of the present group are found only in southwestern Florida and on the Florida Keys, the extent of distribution of each being as yet poorly understood.

The distinctive specialization of the male subgenital plate, as found in typical *hebardi* and also in *micanopy*, may be described as follows. Its lateral margins are dorsal in position, narrowly chitinous and like a knife-edge except near their bases. These margins terminate distad in a straight chitinous spike, directed dorso-mesad, between which a rather deep meso-distal emargination is formed, the margins of which are weakly concave. At the angle thus formed on each side, below the spikes, are located the deeply inset, moderately elongate and evenly tapering styles, which in all but one male before us extend beyond the apices of the spikes above them, reaching but half that distance in a single exception. The depth of the meso-distal emargination is slightly over half its width.

The female subgenital plate is much as that described for *subapterus peninsularis* on page 163, except that it sometimes has the lateral apices bluntly rounded. The ovipositor is also similar, but averages slightly longer.

In these species the coloration is very similar, much as described for *subapterus* on page 157, except that the dark transverse band including the clypeal suture and the fine marginal lines from fastigium to and including the pronotal disk average heavier in the material before us of typical *hebardi* and *micanopy*, though much the same in *hebardi proximus*.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Length of tegmen	Length of caudal femur	
Punta Gorda, Fla., *paratype*	30	2.1	8.3	8.3	17.8	
Ft. Myers, Fla.	26.2	1.9	7.2	6.7	15.7	
Ft. Myers, Fla.	28.3	2.3	7.8	7.1	15.2	
Ft. Myers, Fla.	31	2.4	8	7.7	16.3	
Ft. Myers, Fla.	31.3	2.8	8.3	7.8	17.3	
♀						Length of ovipositor
Ft. Myers, Fla.	30	2.2	7.2	2.2	16.9	22
Ft. Myers, Fla.	31.8	2.7	8	2.3	18.8	21.8
Ft. Myers, Fla.	31	3.1	8.2	2.5	18.8	22.1
Ft. Myers, Fla.	31.3	2.5	8	2.5	19.2	22.3

At Ft. Myers this insect was located in daylight, concealed in the creases of the partially expanded fans of low saw palmetto plants. Long search alone made possible the acquisition of a series, as a large proportion of the plants were unoccupied. At that time the insects were asleep, with fore legs and antennae stretched out straight before them and caudal limbs stretched out straight behind. The hardest beating met with little success, close examination of the plants yielding the bulk of the series. At night males would doubtless have been much more easily secured, as they would have been out stridulating, but search in daylight is probably the best method of securing females.

Specimens Examined, in addition to a male paratype: 72; 31 males, 7 females and 34 immature individuals.

FLORIDA: Ft. Myers, Lee County, IX, 13 to 15, 1917, (Rehn and Hebard; in saw palmettoes of pine (*Pinus caribaea*) flat-woods and in grasses on edge of cypress swamp), 30 ♂, 7 ♀, 11 juv. ♂, 21 juv. ♀, (5 ♂, 4 ♀, 12 juv. ♀ brown); X, 1923, (J. Bell), 1 ♂, (brown), [U. S. N. M.]. Iona, Lee County, IX, 13, 1917, (Rehn and Hebard; in pine (*Pinus caribaea*) woods), 2 juv. ♂ (green).

7a. **Belocephalus hebardi proximus** new subspecies (Pl. VII, fig. 15; pl. VIII, fig. 17.)

This geographic race agrees closely with typical *hebardi* except that the fastigium averages shorter, with its apical spine usually more decurved, the meso-distal emargination of the male subgenital plate is smaller and proportionately narrower and the styles are reduced or have entirely disappeared through atrophy.

Though the majority of our series show only a normal amount of individual variation, the spine of the fastigium sometimes shows less curvature, in one male is exactly as is usual in typical *hebardi* and in the single female is short and almost straight. The meso-distal emargination of the male subgenital plate is also variable to some extent, in but one male approaching the smallest and deepest found in the series assigned to typical *hebardi*. The styles have disappeared in a large number of males, and when present show atrophy in being slender and irregular, rarely reaching as far as the apices of the spikes above them.

Type.—♂; Manatee, Manatee County, Florida. January 1, 1925. (T. H. Hubbell.) [Hebard Collection, Type no. 1074.]

The differences between this and the typical race, and the individual variation found, has been noted above. Fastigium rather short, with apex rather strongly decurved. Emargination of subgenital plate small, slightly broader than deep. Styles absent.

Allotype.— ♀; same data as type but taken January 3, 1925. [Hebard Collection.]

Very similar to male in ambisexual characters. Agrees closely with females of the typical race. Vertex shorter but apparently abnormal for this race in having the apical spine almost straight, scarcely at all decurved.

The coloration of the individuals of this series is much the same as in *subapterus peninsularis*, the dark markings not as decided as in our series of typical *hebardi*.

Measurements (in millimeters)

♂	Length of body	Length of fastigium	Length of pronotum	Length of tegmen	Length of caudal femur	
Manatee, Fla., *paratype*	28.8	1.9	8	8	14.8	
Manatee, Fla., *paratype*	29.8	2.1	8.2	8.7	15.6	
Manatee, Fla., *type*	33.1	2	9	8.3	16.7	
Manatee, Fla., *paratype*	31.7	2.3	8.8	8.4	16.5	
♀						Length of ovipositor
Manatee, Fla., *allotype*	32.5	1.9	8.4	2.8	17.2	22

Specimens Examined: 28; 20 males, 1 female and 7 immature individuals, FLORIDA: Manatee, Manatee County, VIII, 24, 1925, (T. H. Hubbell; in weeds, not in cabbage palmettoes, wary and harder to collect than *sabalis*), 11 ♂ (many teneral), *type* and *paratypes*, 2 juv. ♂, 5 juv. ♀, (1 juv. ♂ and 1 juv. ♀ brown); I, 1 and 3, 1925, (T. H. Hubbell; in tall weeds and grasses with *sabalis*, on moonlight night could only approach within fifteen feet with light off, when song would cease, more numerous than *sabalis*), 9 ♂, 1 ♀, *allotype* and *paratypes*, (1 ♂, 1 ♀ brown), [Hubbell and Hebard Clns.].

Two immature females, taken at Arcadia, Florida, September 12, 1917, by Rehn and Hebard in the undergrowth of the long-leaf pine woods, are apparently referable to this race; the apex of the fastigium being slightly more uncinate than in females of the same instar of typical *hebardi* from Ft. Myers.

Hubbell states in his notes that the song undulates, composed of separate syllables or low buzzing notes which run together "Zeezzeezzeezzeezzee."

8. **Belocephalus micanopy** Davis (Pl. VIII, fig. 18.)

1914. *Belocephalus micanopy* Davis, Jour. New York Ent. Soc., XXII, p. 200, p. 202, fourth fig. (♂, ♀; Big Pine Key, Florida.]

1920. *Belocephalus micanopy* Blatchley, Orth. of North-Eastern America, p. 509. (No additional material.)

This interesting insect is known only from the originally described series of four males and one female, taken from the silver palm (*Coccothrinax argentea* Lodd), which is found through the pine woods of Big Pine Key.

A single male paratype in the author's collection shows no difference whatever from typical *hebardi*, except that the fastigium is bluntly rounded distad, showing no trace of even the vestiges of an apical tooth. The insect therefore differs from typical *hebardi* as *subapterus rehni* differs from typical *subapterus*, but to a greater degree.

In view of this greater difference and the isolation of the type locality, we think it best to give *micanopy* specific recognition, though additional material may show it to be a race of *hebardi*.

The coloration agrees fully with that of *hebardi*, one of the original series being green, the others brown.

Measurements (in millimeters)

♂	Length of body	Length of fastigium[31]	Length of pronotum	Length of tegmen	Length of caudal femur	
Big Pine Key, Fla., *type*[32]	30	2	9	7.5	16	
Big Pine Key, Fla., *paratype*	29	1.5	8.8	7.8	15.5	
♀						Length of ovipositor
Big Pine Key, Fla., *allotype*[32]	30	2	9	3	16	19

Davis states that "The song of this species is slow and readily distinguishable from that of *Belocephalus sleighti.*" We have elsewhere noted that the song of the species of the genus probably changes in speed with changes of temperature. We believe, however, that the song of *sleighti* and *sabalis* is more rapid than that of *micanopy* and *hebardi.*

[31] This dimension as taken by Davis is from the antennal base to apex, as taken in the present paper from apex of basal ventral tooth to apex. The former measurement slightly exceeds the latter.

[32] From Davis.

Explanation of Figures

Plate VII

Fig. 1.—*Belocephalus subapterus subapterus* Scudder. Male. Seven Mile, South Carolina. Dorsal view of ultimate tergite. (Much enenlarged.)

Fig. 2.—*Belocephalus subapterus subapterus* Scudder. Female. Gainesville, Florida. Lateral view of apex of abdomen, base of ovipositor and subgenital plate. (Much enlarged.)

Fig. 3.—*Belocephalus subapterus peninsularis* n. subsp. Male. *Type.* Lakeland, Florida. Dorsal outline of ultimate tergite. (Same scale as Fig. 1.)

Fig. 4.—*Belocephalus subapterus peninsularis* n. subsp. Male. *Type.* Lakeland, Florida. Caudal view of cercus. (Greatly enlarged.)

Fig. 5.—*Belocephalus uncinatus* n. sp. Male. *Type.* Miami Beach, Florida. Caudal view of cercus. (Same scale as Fig. 4.)

Fig. 6.—*Belocephalus hesperus,* n. sp. Male. *Type.* St. Elmo, Alabama. Dorsal outline of ultimate tergite. (Same scale as Fig. 1.)

Fig. 7.—*Belocephalus hesperus* n. sp. Male. *Type.* St. Elmo, Alabama. Caudal view of cercus. (Same scale as Fig. 4.)

Fig. 8.—*Belocephalus hesperus* n. sp. Female. *Allotype.* St. Elmo, Alabama. Lateral view. (× 1½)

Fig. 9.—*Belocephalus davisi* Rehn and Hebard. Female. Newberry, Florida. Lateral view of apex of abdomen, base of ovipositor and subgenital plate. (Same scale as Fig. 2.)

Fig. 10.—*Belocephalus sabalis* Davis. Male. *Paratype.* Punta Gorda, Florida. Lateral outline of head. (× 2)

Fig. 11.—*Belocephalus sleighti simplex* n. subsp. Male. *Paratype.* Homestead, Florida. Lateral outline of head. (× 2)

Fig. 12.—*Belocephalus sleighti simplex* n. subsp. Male. *Type.* Homestead, Florida. Lateral outline of head. (× 2)

Fig. 13.—*Belocephalus sleighti simplex* n. subsp. Male. *Type,* Homestead, Florida. Ventral view of meso-distal portion of subgenital plate and styles. (Greatly enlarged.)

Fig. 14.—*Belocephalus hebardi hebardi* Davis. Male. Ft. Myers, Florida. Ventral view of meso-distal portion of subgenital plate and styles. (Same scale as Fig. 13.)

Fig. 15.—*Belocephalus hebardi proximus* n. subsp. Male. *Type.* Manatee, Florida. Ventral view of meso-distal portion of subgenital plate. (Same scale as Fig. 13.)

Plate VIII

Fig. 1.—*Belocephalus subapterus subapterus* Scudder. Male. Seven Mile, South Carolina. Lateral view of fastigium. (Greatly enlarged.)

Fig. 2.—*Belocephalus subapterus subapterus* Scudder. Male. Dothan, Alabama. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 3.—*Belocephalus subapterus rehni* Davis. Male. Dunnellon, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 4.—*Belocephalus subapterus peninsularis* n. subsp. Male. *Type.* Lakeland, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 5.—*Belocephalus uncinatus* n. sp. Male. *Type.* Miami Beach, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 6.—*Belocephalus uncinatus* n. sp. Male. *Type.* Miami Beach, Florida. Dorsal outline of ultimate tergite. (Much enlarged, same scale as Pl. VII, fig. 1.)

Fig. 7.—*Belocephalus hesperus* n. sp. Male. *Type.* St. Elmo, Alabama. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 8.—*Belocephalus davisi* Rehn and Hebard. Male. *Type.* Billy's Island, Georgia. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 9.—*Belocephalus davisi* Rehn and Hebard. Male. *Type.* Billy's Island, Georgia. Dorsal outline of ultimate tergite. (Same scale as Fig. 6.)

Fig. 10.—*Belocephalus sabalis* Davis. Male. *Paratype.* Punta Gorda, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 11.—*Belocephalus sabalis* Davis. Male. *Paratype.* Punta Gorda, Florida. Dorsal outline of ultimate tergite. (Same scale as Fig. 6.)

Fig. 12.—*Belocephalus sleighti sleighti* Davis. Male. *Paratype.* Big Pine Key, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 13.—*Belocephalus sleighti sleighti* Davis. Male. *Paratype.* Big Pine Key, Florida. Dorsal outline of ultimate tergite. (Same scale as Fig. 6.)

Fig. 14.—*Belocephalus sleighi simplex* n. subsp. Male. *Type.* Homestead, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 15.—*Belocephalus sleighti simplex* n. subsp. Male. *Type.* Homestead, Florida. Dorsal outline of ultimate tergite. (Same scale as Fig. 6.)

Fig. 16.—*Belocephalus hebardi hebardi* Davis. Male. Ft. Myers, Florida. Dorsal outline of ultimate tergite. (Same scale as Fig. 6.)

Fig. 17.—*Belocephalus hebardi proximus* n. subsp. Male. *Type.* Manatee, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

Fig. 18.—*Belocephalus micanopy* Davis. Male. *Paratype.* Big Pine Key, Florida. Lateral view of fastigium. (Same scale as Fig. 1.)

HEBARD—THE GENUS BELOCEPHALUS

HEBARD—THE GENUS BELOCEPHALUS

NOTES ON SOME NORTH AMERICAN SPECIES OF ACHAETONEURA WITH A DESCRIPTION OF ONE NEW SPECIES (DIPTERA; TACHINIDAE)[1]

BY H. W. ALLEN

A number of the most common North American species of Tachinidae have heretofore been placed by authors in the genus *Frontina*. This genus, erected by Meigen,[2] has as the first species *laeta* Meigen, which was designated as the type of the genus by Desvoidy.[3] This species, according to Pantel,[4] belongs to the group which deposits microtype eggs on foliage. The common North American species referred to this genus, have, as will be explained in this paper, a distinctly different manner of reproduction, and thus cannot be congeneric with *laeta*.

The name *Achaetoneura* was proposed by Brauer & Bergenstam,[5] to include *hesperus*, the first species. But according to Coquillett,[6] *hesperus* B. & B. is a synonym of *frenchii* Williston, an older name. It appears then that North American species formerly placed in the genus *Frontina* really belong to the genus *Achaetoneura*, of which *frenchii* becomes the genotype. *Achaetoneura* is not congeneric with *Prosopaea* Rondani, which is limited by Stein,[7] to species without preapical bristles.

Four North American species *frenchii*, *aletiae*, *archippivora* and *melalophae* have the same type of external genitalia and three of these deposit the same type of maggot as indicated in this paper. It is noteworthy that each also possesses the same type of puparium with serpentine spiracular slits, and they thus form a small but well differentiated natural group. The female

[1] A contribution from the Mississippi Agricultural Experiment Station.

[2] Syst. Beschr. Zweifl. Ins., vol. 7, p. 247, 1838.

[3] Hist. Nat. Dipt. vol. 1, p. 580, 1863.

[4] Recherches sur les Diptères à larves entomobies, La Cellule, vol. 26, p. 46, 1910.

[5] Zweifl. der Kais. Mus. Pt. v, p. 30, 1891.

[6] Revision of Tachinidae, p. 107, 1897.

[7] Die Verbreitetsten Tachinen Mitteleuropa, p. 30, 1924.

reproductive apparatus suggests a relationship of the *Achaetoneura* group with the *Sturmia inquinita, distincta* complex, but there are too many differences in life histories for them to be considered identical. The former should perhaps be considered as a rather distinct subdivision of Pantel's Group VI, of species depositing eggs at the point of hatching or hatched larvae upon the body of the host,[8] and in which its nearest relatives are to be found. Though one species, *aletiae* has developed subcutaneous larviposition, its reproductive apparatus, both external and internal, remains remarkably like the more generalized species of the group, to which it is very evidently, even now, more closely related than to the other more highly specialized host-piercing types such as *Celatoria, Compsilura*, and related genera in which the piercer is very long, recurved and apposed to secondary spines or similar organs allowing the adult parasite to grapple with and clasp its prospective host.

Achaetoneura aletiae Riley

Hosts and Adult Habits

This common North American species is decidedly polyphagous, and has been recorded by Coquillett[9] and others from a considerable number of caterpillar hosts. It has been reared in Mississippi from the spiny elm caterpillar (*Aglais antiopa* L.), the corn ear worm (*Heliothis obsoleta* Fab.), the cotton worm (*Alabama argillicea* Hueb.), the flannel-moth caterpillar (*Megalopyge opercularis* S. & A.), *Autographa oo* Cram. and undoubtedly contributes to the control of several other local pests.

Adults are present from the middle of May until the end of November, becoming more abundant in the fall. They have been observed repeatedly feeding at the nectaries of cowpeas, and though not typical flower-feeders, have been seen at the flowers of mung beans and *Chrysanthemum*.

[8] Recherches sur les Diptères à larves entomobies, La Cellule, vol. 26, p. 77, 1910.

[9] Revision of Tachinidae, p. 15.

Female Reproductive Organs

The much enlarged utero-vagina, and the external piercing genitalia, constitute the distinctive features of the female reproductive apparatus (fig. 4). The utero-vagina serves as an incubatory chamber, in which the eggs, side by side, in closely packed diagonal rows of 12 to 14, develop, as they pass downwards, to maggots which are retained within a thin flexible chorion sheath until the time of hatching (fig. 2). The utero-vagina is round and thick-walled at its junction with the external genitalia, but expands distally to enclose the highly characteristic raft-like pack of eggs, arranged in a single coil. The external genitalia (figs. 4, p. and 7) are considerably larger than those of surface ovipositing forms, and more heavily chitinzed and can be extended for a distance about equal to the length of the chitinized portion. They consist of a truncately conical basal segment, into the apex of which the rather short, straight piercing valves are inserted. In repose, the external genitalia are telescoped within the tip of the abdomen to the length of the reversible basal membrane, leaving only the tips of the piercing valves exposed (fig. 3).

Method of Establishing the Progeny on the Host

Females usually approach their victims from the side, spring upon them suddenly, at the same time driving the piercer forward from beneath. The action of larviposition is so rapid that it cannot be accurately followed by the eye. Caterpillars which have been attacked, when examined immediately afterwards are found to bear wrinkled, membraneous egg-shells attached to various parts of the body. The naked maggots being freed from the egg shell at the instant the host is punctured, are shot through into the body of the caterpillar. If the egg shell be removed immediately following parasite attack, a minute slit-like puncture still wet with caterpillar blood will be found. The flow of blood is apparently checked by the presence of the egg shell over the puncture, the blood in the puncture soon hardening, sealing the puncture, the evidence of which remains as a narrow black slit, even after the membraneous

egg shells have been torn away (fig. 1). The fly usually injects its maggots through the venter or pleuron of the host, but has been observed to puncture the tergum as well. From the dissection of caterpillars it appears that in thin-walled species, the maggots are injected into or through the hypodermal layer, wriggling their way almost immediately into the haemolymph, but in the case of the thick-walled *Epargyreus tityrus*, maggots were deposited in several instances between the cuticula and the hypodermal layer. The fly deposits larvae in rapid succession, striking its host several times each minute. There appears to be no limit to the number of maggots it will deposit in a single host caterpillar, though in the field it probably does not grossly overstock a caterpillar with maggots as it will do if confined with a limited number in a cage.

Parasitic Period

The parasitic life was studied during September, in a limited number of caterpillars of two of its normal hosts, the cotton worm, and the fall armyworm (*Laphygma frugiperda* S. & A.). One caterpillar dissected after about 24 hours' exposure to attack by the adult, and upon which numerous typical scars covered with membranous egg shells were observed, was found to contain a large number of minute 1st instar maggots most of which were free in the haemolymph, although several were buried in Malpighian tubes and silk glands (fig. 6), and one or two were noted within the lobes of the fat bodies. Whether penetration of such organs as the silk glands, Malpighian tubes and fat bodies is a necessary step in the maggot life was not determined. Further dissections indicate that on about the second day of its parasitic life and during the first instar, the maggot attaches itself to a large trachea at or near its junction with the spiracle, piercing the trachea and by its presence inducing the usual inflammatory reaction of the caterpillar with its production of a ball of tumor-like tissue, sheath, and chitinous breathing funnel opening into the trachea, and in which the posterior end of the maggot is seated (fig. 5). This is the typical secondary breathing puncture mentioned by Pantel and other authors.

For the duration of the first instar of the parasite, the host caterpillar continues to develop, showing no marked pathological symptoms. The ensheathed maggot molts to the second instar while still seated in the breathing funnel, the exuviae of the first instar being incorporated with the other tissues of the sheath. Towards the end of this instar, the maggots apparently forsake the funnel and wander through the body cavity, molting to the third instar while free in the body cavity (in one apparently normal specimen, the molt skins of the second instar were found free in the body cavity). During the second instar, the damage to host tissues are extensive, host death resulting in this or the early third instar. After death, histolysis and decomposition of the soft tissues is rapid, the third instar maggot growing very rapidly upon the decomposed body contents of its host. In one specimen, a minute, nearly round breathing hole cut in the notum of the prothorax of the dead pupa, was used by the maggot as a breathing hole, the anal spiracles being applied to it at frequent intervals. In some cases the parasite effected the death of the host in the last instar, in others passing through with it into the pupal stage. The maggot emerged from the body of its host, crawled about an inch away, and formed the puparium about ½ inch under the soil surface when emerging upon deep loose soil. In the cotton worm and corn ear worm one to two maggots come through to maturity in each caterpillar.

Durations

The time durations taken for a limited number of specimens in the moderately warm weather of September were eight to eleven days for the maggot stage, nine to fourteen days for the puparium, and a combined maggot and pupal duration of nineteen to twenty-five days. From observations based on a number of dissections it appears that the minute first instar maggot wanders freely in the haemolymph but a few hours after penetration, becoming established in the secondary breathing funnels on the second day. The duration of the first instar maggot was approximately four days, that of the third, three to five days, while the second was apparently considerably shorter, scarcely exceeding a day.

Achaetoneura melalophae new species

This parasite is one of the important natural controls of the poplar tentmaker (*Melalopha inclusa* Hueb) which is periodically abundant upon Lombardy poplar, Carolina poplar and willow, in the Southern States. As high as sixty per cent parasitism in caterpillars of the last two instars has been noted. Although it is known that great numbers of caterpillars are destroyed by this parasite, the adult is rarely encountered in the field, only one, taken in late April on the foliage of peach, has ever been observed by the writer.

The method by which this species establishes itself upon its host has not been definitely determined. It has, however, the same type of genitalia present as in *A. aletiae*, though somewhat smaller and weaker, and also possesses an incubatory uterovagina, in which the eggs develop to the active maggot stage. The fly may establish its progeny by subcutaneous host larviposition as in *aletiae*, though this is by no means certain.

Parasitic Period

Parasite maggots occur in at least the last three instars of caterpillars collected in the field, and attack by the adult may begin even earlier in the caterpillar existence. The parasite does not appear to be seriously inconvenienced by the tent living habit of its host, evidently taking advantage of the fact that larvae spend some time upon the foliage outside of the closely woven tents.

Young maggots pass most of the first instar embedded in lobes of the fat body, their location near the junction of the fore and hind gut being as characteristic as the position in the fat body. During this instar there is only a slight inflammatory reaction confined to that part of the fat body infested by the maggot. Caterpillar activity during this period is normal. Transformation to the second instar takes place while still embedded in the lobes of the fat body, the mouthhooks of the first instar being incorporated with the surrounding tissue. The tumor-like capsule surrounding the maggot becomes somewhat more pronounced during this instar, and the maggot establishes contact with one of the larger tracheae, cutting a hole in it near the junction with the spiracle, and stimulating

the production of the usual breathing funnel. The funnel remains very short, is only lightly pigmented and more or less flexible, being rather vaguely defined and readily overlooked. Apparently the maggot molts once more, while still embedded in the fat body, the third instar maggot, releasing itself from the breathing funnel, completes its growth while roaming freely in the body cavity. During this instar maggots were observed applying the anal spiracles to ruptures torn in the side of the dead host and also to the spiracles, evidently securing an abundant supply of air in this manner.

Death of the host occurs either in its last larval instar or the pupal stage, and usually when the parasite within is in the third instar. The maggot after completing its development upon the decomposing body of its host, emerges to pupate. Several instances have been noted in the field where puparia were formed on the tree within the tents of the host and in close proximity to the caterpillar victims. However, in the insectary, maggots displayed a marked inclination to burrow in the soil to pupate, forming the puparia about ½ inch beneath the surface. The latter is probably the usual procedure in the field.

Durations

The pupal duration determined during late July and early August, ranged from six to nine days for seven males, nine to eleven days for five females, averaging nine and one-tenth days for both sexes. As is usual with Tachinidae, the pupal duration of the female is slightly longer than that of the male. Several puparia formed in September and October had from eight to nine days duration. However, in the puparia of the hibernating generation, the duration was much more extended, being fifty-four to sixty-two days. No direct information was secured upon parasite duration within the host, owing to the difficulty of securing caterpillars in the initial stage of parasitism. However, in several lots of caterpillars collected during late July and August, all maggots of this species completed their development within twelve days after being collected, this duration can then be accepted as indicating roughly the maximum larval duration in the host at this season of the year. The maggot duration in hibernating caterpillars and pupae is naturally much more extended.

Seasonal Cycle

Adults appeared in the insectary under normal temperatures from the middle of February until the middle of October. There are at least two generations each season, and very likely several more. The species passes the winter as a maggot within the pupae of its host and also as a puparium, adults from the latter commencing to emerge in the first warm days of early spring.

Ecological Relations

The maggots display a limited degree of tolerance for their own species. As many as eight second instar maggots have been found in single caterpillars collected from the field. From two to five puparia were secured from one host, though in many but one maggot emerged. In the late fall of 1923, this parasite came into direct competition with *Phorocera floridensis* Tns. In the many cases under observation, this competition resulted unfavorably to the latter, in which the maggots hatched from the eggs and even penetrated the host, but were invariably overwhelmed by the untimely death of the host due to the more advanced development of the maggots of *melalophae* which had very likely been established upon the host at a somewhat earlier date. In these caterpillars attacked by the two species, a large percentage of *melalophae* came through normally, apparently being little affected by the superparasitism.

A small proportion of the maggots, while still within the body of their host, are attacked by the Hymenopterous hyperparasite, *Perilampus hyalinus* Say,[10] which occur as conspicuous planidia beneath the cuticula of the fly maggot, and emerge later from the puparia as brilliant green adults.

Little is known of the geographical distribution of this parasite. It has been reared in large numbers from the poplar tentmaker at A. & M. College, Mississippi, and Columbus, Ohio, and undoubtedly has a wide distribution in the eastern United States.

[10] Determined by C. F. W. Muesebeck.

Description

This species runs to *frenchii* Will. in Coquillett's key to Frontina,[11] but is readily distinguished by its more slender shape and smaller size. The front in both sexes is much less than the width of either eye; both front and face are deeply golden pollinose; and the mottled pollination of the abdomen is also quite distinct from the more uniform sheen of *frenchii*.

Male: Front at narrowest, one-fourth diameter of head; face and front yellowish pollinose sometimes becoming blackish at vertex; frontal vitta brown, narrowest at middle where it is slightly narrower than parafrontal; the anteriorly directed ocellars as strong as frontal bristles on either side; parafrontal with usual frontal row descending to level of insertion of arista, and with fine sparse hairs which are more abundant near the vertex; facial ridge with single row of small macrochaetae on lower half; antennae black, third joint five to six times as long as second, arista thickened on basal two-fifths, its penultimate joint distinctly longer than broad; palpi yellow; in profile view, buccal width about one-fourth eyeheight and wider than narrow parafacial, the outer margin of which is noticeably convex.

Thorax gray pollinose, with four nearly equal and parallel black vittae; four postsutural dorsocentrals and four sternopleural bristles, of which the intermediate two are much the weaker; scutellum slightly yellowish at tip, with four pairs of marginals, the apical pair being well developed and directed vertically, and one pair of strong discals. Abdomen black or at most with indistinct spot of red at sides of second segment, densely overlaid with gray pollen in which irregular black areas appear when viewed from behind in addition to two spots on median dorsal line; the rather coarse suberect bristly hairs are surrounded at their insertions by conspicuous round black spots; fourth abdominal segment densely pollinose to apex; a median marginal pair of macrochaetae on each of the first two segments, an uninterrupted marginal row on the third, and macrochaetae of various sizes and large erect hairs more or less densely distributed over the fourth. Wings hyaline, apical cell narrowly open, ending not far before extreme tip of wing; costal spine absent, two to four bristles at base of third vein. Legs black; pulvilli of fore leg longer than fifth tarsal joint; middle tibia with one strong bristle; hind tibia on outside surface ciliate with comb of rather short weak bristles of which one slightly beyond the middle is distinctly the largest.

[11] Revision of Tachinidae, p. 106, 1897.

Female: Closely resembles the male but differs in having two pairs of orbital bristles. The third antennal joint is reddish at the base and varies from three and one-half to five times as long as the second. The pulvilli are much shorter than the fifth tarsal joint.

Length: 5.0 to 8.0 mm.

Type.—Male; Agricultural & Mechanical College, Mississippi, 17, VII, 1924.

Allotype.—Female; Agricultural & Mechanical College, Mississippi, no date.

Described from the type and allotype deposited with the U. S. National Museum and the following paratypes in the collection of Mississippi A. & M. College, all of which were reared by the writer from *Melalopha inclusa* with the exception of one collected specimen: 1 male, August 28, and 1 female August 29, 1921, Columbus, Ohio. 1 male, fall of 1923; one male, October 3, 1923; 1 female, March 16, 1924; 1 male, March 22, 1924; 1 male, March 24, 1924; 1 male July 25, 1924; 1 male and 1 female, August 17, 1924; 2 females, August 18, 1924; 1 male, September 17, 1924; and 2 females with no date, all from Agricultural & Mechanical College, Mississippi; 1 male collected on foliage of peach, Agricultural & Mechanical College, Mississippi, April 21, 1924.

Achaetoneura frenchii Williston

The reproductive habit of *frenchii* has not been fully worked out. The external genitalia (fig. 9) are of the same character as the two preceding species, though somewhat more blunt than in *aletiae*. Uterine maggots are of the same type as figured for *aletiae*. The female reproductive apparatus is morphologically similar to the above two species, though it may not have developed subcutaneous host larviposition as in *aletiae*.

Achaetoneura archippivora Williston

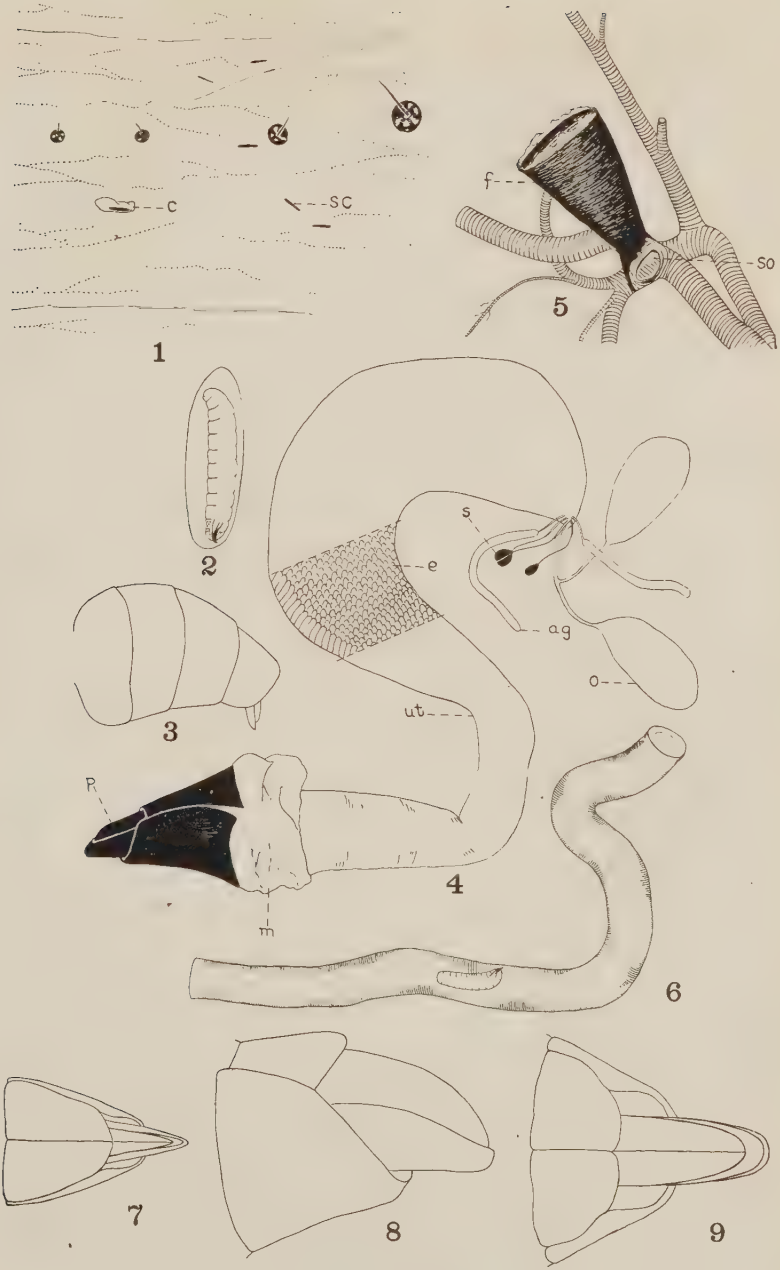
The external genitalia of *archippivora* are similar to *frenchii*. Several females have been dissected but were evidently immature, as no fully formed ova or maggots were found.

Explanation of Plate IX

Fig. 1.—Cuticula of caterpillar showing the puncture scars of *A. aletiae*.
Fig. 2.—Uterine egg of *A. aletiae* with larva as seen through nearly transparent chorion.
Fig. 3.—Lateral aspect of the abdomen of the female, *A. aletiae* showing the protruding tip of the piercer.
Fig. 4.—Female reproductive system of *A. aletiae*.
Fig. 5.—Respiratory funnel of 2nd instar larva, *A. aletiae*, attached to trachea of host near junction with spiracle.
Fig. 6.—First instar larva of *A. aletiae* within salivary gland of the host.
Fig. 7.—External genitalia of the female of *A. aletiae*, dorsal aspect.
Fig. 8.—External genitalia of female of *A. frenchii*, lateral aspect.
Fig. 9.—Same as 8, dorsal aspect.

Abbreviations

ag.....Accessory gland.
c.....Chorion egg shell covering puncture scar.
e.....Eggs in utero-vagina.
f.....Breathing funnel.
m.....Collapsible membrane attached to base of genitalia.
o.....Ovary.
p.....Heavily chitinized piercer.
s.....Spermathaeca.
so.....Outlet from trachea to spiracle.
ut.....Utero-vagina.



ALLEN—AMERICAN ACHAETONEURA

A COMPARISON OF THE NECK AND PROTHORACIC SCLERITES THROUGHT THE ORDERS OF INSECTS FROM THE STANDPOINT OF PHYLOGENY

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Despite the fact that the neck and prothoracic sclerites offer the most valuable clues for tracing the evolution and interrelationships of the larger groups of insects, these structures have never been studied from the phylogenetic standpoint. Furthermore, a surprisingly large number of the generally accepted interpretations of the homologies of the sclerites are incorrect, and it is only by making a comprehensive study of a wide range of forms from all of the orders, that one can hope to determine the true homologies of the parts and the developmental paths followed in the evolution of the various types. I have therefore endeavored to include in the following discussion, all of the important types of modifications met with in adult insects, and many of the interesting variations met with in the immature forms as well, although I would not make any claim to completeness, in this presentation.

Prior to 1900, but little attention was given to the study of the thoracic sclerites, and the investigations of Audouin, 1824, Westwood, 1832, Brauer, 1882, and Packard, 1883 (who were the outstanding figures of the period) were not very extensive or detailed. Interest in the subject of the homologies of the thoracic sclerites was revived by the rather startling views presented by Verhoeff, 1902–1903; and in 1908–1909, the writer began a series of articles on the subject, followed by the classic paper of Snodgrass, 1909, and the monumental work of Berlese, 1909. The investigations of Snodgrass, 1910, Martin, 1916, Taylor, 1918, Young, 1921, and Weber, 1924, have added much to our knowledge of the subject, and the writer has contributed short papers from time to time, but a detailed and thoroughgoing study of the thoracic sclerites (or any other structures, for that matter) from the lowest to the highest forms, has never been made, and the present paper is offered to supply this lack. Since it has been necessary to use eight plates to illustrate the modifications of the neck and prothoracic sclerites alone, it is quite evident that it would be impossible adequately to treat of the modifications of the sclerites of all of the thoracic segments in a single paper. I would therefore defer the consideration of the sclerites of the mesothorax and metathorax until these can be discussed in detail in subsequent papers.

Feuerborn, has recently attempted to revive the long-since discarded views that there are more than three segments in the thorax of insects, but, as was pointed out by the writer in a former paper (Crampton, 1917) a fatal objection to such unfounded hypotheses is the fact that there are not the slightest traces of more than three neuromeres, or metameres, in this region in any insectan embryo. Furthermore, the ganglia and other segmental structures give no indication whatsoever of the presence of more than three segments in the thorax in any stage of development, and until such objections are met, it is useless to indulge in futile speculations concerning non-existent extra segments in the thorax.

MacGillivray, 1923, follows Comstock and Kochi, 1902, in regarding the lateral neck plates as the episternum and epimerum of the labial segment of the head, and MacGillivray makes the unsupported statement that the neck plates are not comparable

to the other intersegmental sclerites "in position, form, structure, or function." It should be unnecessary to repeat, however, that embryological investigations of such men as Holmgren, 1909, and others, have shown that the entire labial metamere enters into the composition of the head capsule itself; and the labial pleural region (containing the homologues of the labial episternum and epimerum) takes part in the formation of the head region about the occipital foramen. Furthermore, the position of the lateral neck plates immediately in front of the precoxal bridge of the prothorax, clearly demonstrates that these neck plates are the homologues of the lateral plates situated in front of the precoxal bridge in the mesothorax and metathorax of certain primitive insects, thus clearly indicating the intersegmental nature of the lateral neck plates, as will be discussed presently.

In the following discussion, I have purposely avoided the use of diagrams, since these all too frequently represent merely some unfounded view of a person not sufficiently conversant with the subject to know whether he is depicting actual occurrences or not. On the other hand, when one uses actual cases to illustrate the stages of development in tracing the derived types from their precursors, one is on safe ground, since wh t nature has done, at least shows what nature can do; and one thus avoids the possibility of postulating developmental steps never taken by nature or similar absurd assumptions. In using actual cases, however, I would not imply that any primitive living form is actually ancestral to a derived living type. In such cases, I have merely made use of the primitive conditions exhibited by certain forms which have not travelled as far along the road to specialization (which both are following) as certain derived types have done. This principle is well known to every student of evolution and need cause no criticism.

In figure 15 are shown the intersegmental plates in front of the mesothorax of the primitive Apterygotan insect *Eosentomon*, so that one may compare these intersegmental plates with the intersegmental plates in front of the prothorax (i. e. the neck plates) of a Pterygotan insect such as *Capnia*, shown in figure 18. In both instances, the sternal subdivision labelled *bs* is connected with the pleural plate *ep* by a precoxal bridge *ls* and

pr extending in front of the coxa, and connecting the pleural and sternal sclerites. Using this as a landmark, one may readily see that the sclerites labelled *ip* immediately in front of the precoxal bridge *ls* of the mesothorax in figure 15 are homologous with the sclerites labelled *lc* in front of the precoxal bridge *pr* of the prothorax in figure 18. Similarly, the sternal sclerites *ps* and *is*, in front of the bridge-bearing sternal sclerite *bs* of the mesothorax in figure 15 are homologous with the sternal sclerites *ps* and *is* in front of the bridge-bearing sternal sclerite *bs* of the prothorax in figure 18. The intertergite or dorsal plate of the neck region (i. e. the plate labelled *it* in figure 18) may represent the dorsal plate *it* in front of the mesothorax in figure 15, but this point has not been definitely settled. In other Apterygota such a *Japyx*, (Fig. 25) there is a dorsal intersegmental plate *it* in front of the mesothorax, and this plate is probably homologous with the dorsal plate, or intertergite *it* in front of the prothorax, so that in *Japyx* even the dorsal intersegmental plates *it* in front of the prothorax (i. e. the dorsal neck plates) have their counterparts in the dorsal intersegmental plates *it* in front of the mesothorax; and it is thus possible to homologize all of the neck plates with the other intersegmental plates in front of the mesothorax or metathorax. I would therefore maintain that the neck plates are purely intersegmental structures formed secondarily, and having nothing to do with the labial segment or an extra thoracic segment, and this view seems to me to be the only one having any basis whatsoever in fact!

In comparing the sclerites of the Apterygota with those of the Pterygota, one is struck with the fact that in the Apterygota as a whole, the plates are feebly developed, or weakly chitinized, and the neck plates in particular are poorly developed. On this account, the study of the neck and prothoracic plates is not of as great value for indicating relationships as is the case with the Pterygota, in which these parts are usually well developed.

In a previous paper (Crampton, 1916) I have called attention to the fact that in the nature of their abdominal structures such as the styli, cerci, etc., the Dicellura (i. e. *Japyx*, *Campodea*, etc.) resemble the Thysanura (*Lepisma*, etc.) much more closely than they do the Collembola and Protura. In a later paper

(Crampton, 1923) I called attention to the fact that in the character of their mouthparts (even in the minuter details) the Dicellura are much nearer to the Collembola and Protura; and in the present paper, I would point out that in their thoracic features also, the Dicellura are much nearer to the Protura than they are to the Thysanura, so that we must regard the Dicellura as anatomically intermediate between the lower and higher Apterygota, instead of grouping the Dicellura with the Thysanura, as is frequently done.

The Protura (Fig. 24) resemble the Dicellura (Fig. 25) in having a large spinasternum *ss* with laterally projecting extensions (or angularly projecting sides), and the basisternum *bs* with its incomplete precoxal bridge *ls* is rather similar in both. These two groups are the only Apterygota in which the prothoracic presternum *ps* is not greatly elongated transversely, and they are the only Apterygota in which there are traces of the mesothoracic sclerites is_2 and ps_2 behind the prothoracic sternal subdivision *ss*.

In the Protura, the fore legs are directed forward to serve as "feelers" (the antennae are absent in Protura) and this modification of the front legs is accompanied by profound changes in the arrangement of the upper prothoracic and neck sclerites, so that these are not very similar in the Protura and Dicellura—nor are these sclerites in the Protura very similar to those of any other insects known to me.

If the sclerite labelled *tn* in *Eosentomon* (Fig. 24) is really the trochantin, it is situated surprisingly far forward (in connection with the shifting of the prothoracic coxae *cx*) and it is not very similar to the trochantin *etn* of *Japyx* (Fig. 25) which is closely associated with the base of the coxa *cx*, and may even be a detached portion of the coxa. The episternum *es* and epimerum *em* of *Eosentomum* (Fig. 24) are situated rather far back in respect to the base of the coxa *cx*, while in *Japyx* (Fig. 25) the plate *ep*, which contains the episternum and epimerum, is situated immediately above the base of the coxa *cx*, and is rather closely associated with the coxa.

The pronotum *pn* of *Japyx* (Fig. 25) is not composed of several small sclerites as in *Eosentomum* (Fig. 24), and this feature in *Eosentomum* is rather suggestive of the condition occurring in

the pronotal region of certain Collembola (Fig. 19) in which there are several small sclerites in the pronotal region.

The lateral neck plates *lc* are fairly distinct in *Japyx* (Fig. 25), and this is the only Apterygotan insect in which these neck plates are suggestive of those of Pterygotan insects. The sclerites labelled *lc* in figure 24 of *Eosentomon*, are usually interpreted as the homologues of the lateral cervical sclerites of Pterygotan insects. There is something in them very suggestive of the processes called the occipital condyles in Pterygotan insects, but I am not prepared to say that these sclerites in *Eosentomon* are homologous with the region of the occipital condyles of higher forms. The sclerites in question in *Eosentomon* (i. e. *lc* of Fig. 24) are rather suggestive of the sclerite labelled *p* in *Japyx* (Fig. 25) in relation to the head capsule, etc., but until more material is available to determine the homologies of these sclerites, it is preferable to follow the generally accepted interpretation and provisionally, at least, to refer to them as the lateral cervicals.

In the Collembola (Fig. 19 and 21) the presternum *ps* is transversely elongated, and shows indications of dividing into two halves. The basisternum *bs* is also composed of two halves, and the same is true of the furcasternum *fs*. The basisternum and furcasternum become greatly narrowed between the coxae, due to the approximation of the coxae. The trochantin *tn* is very closely associated with the coxa *cx*, and has the appearance of being a detached portion of the coxa. The pleural plate *ep* of figure 19, is poorly chitinized, and the sclerites of the pronotum are represented by small pigmented areas, rather suggestive of the condition occurring in the pronotal region of holometabolous larvae. The sclerites of the Collembola are somewhat suggestive of those of the Protura and Dicellura, but the resemblance is not marked, and the sclerites of the Collembola are too weakly developed, and too unsatisfactory in nature to afford much evidence of relationships to other forms. The Collembola apparently represent a rather specialized offshoot of Protura-like ancestors, and they have certain features suggesting a relationship to the Dicellura, but their line of descent leads off in a direction having no especial bearing on the evolution of the higher forms.

In *Lepisma* (Fig. 17) the presternum *ps* is transversely elonated and is closely associated with the basisternum *bs*, suggesting that the presternum may possibly be a detached portion of the basisternum. A precoxal bridge *pr* connects the sternal region with the pleural sclerite *ep* (containing the areas homologous with the episternum and epimerum of other insects) and the pleural sclerite is situated immediately above the trochantin *tn*, which is closely associated with the coxa *cx* (of which it may be a part). The trochantin sends back a narrow posterior prolongation extending for a short distance behind the coxa, and this type of sclerite which intervenes between the coxa and the pleural sclerite, and sends backward a process making the trochantin of greater extent than the true trochantin, is called a "eutrochantin." The posterior portion of a eutrochantin usually unites with the lower portion of the pleural plate in higher forms and the anterior portion of the eutrochantin then becomes detached to form a trochantin, which is thus a more specialized structure than is the eutrochantin. The trochantin region *tn* of *Lepisma* is quite broad, and is very suggestive of the Orthopteroid type of trochantin among the Pterygota. The trochantin and the pleural plate are very closely associated with the base of the coxa, and this has led to the supposition that they are detached portions of the coxa, but the evidence is not wholly convincing that these sclerites have arisen through becoming detached from the coxa, although I would not deny the possibility of such an origin. The sternal plate is very large in the Lepismatid shown in Fig. 17 and the pronotum is very large and overlaps the pleural region and the base of the coxa.

In the Crustacea, the pleural sclerities are extremely poorly developed, and it is possible that *Machilis*, in inheriting many tendencies from its Crustaceoid ancestors also inherited the tendency toward a poor development of these sclerites, from the same source. The sclerites of *Machilis* are so weakly developed and pigmented, that it is very difficult to make out very much about them, but there are certain features of interest which merit mention. The pleural plate is divided by an oblique suture, into an epimeral region *em* (Fig. 16) and episternal region *es*, and this suture is formed by the meeting of the external lips of an internal fold extending along the suture in question.

It is very probable that the episternum and epimerum thus arose by the secondary marking off of an anterior and posterior region in a single pleural plate, as was pointed out by the writer in 1908. In *Machilis*, there is an anterior prolongation *lc* of the pleural plate which sends forward a process to the head region. This anterior process may represent the lateral neck sclerites of higher insects, and in such a case, one might infer that the neck plates were derived from detached portions of the pleural plates, although it must be admitted that the evidence for such a derivation of the neck plates is no stronger than that for considering that they arose as the result of secondary deposits of chitin and pigment in the intersegmental region between the rest of the prothorax and the head.

The trochantin is not well developed in *Machilis* and if the raised ridge-like antero-basal portion of the coxa bearing the label *tn* in figure 16 represents the trochantin, the latter is even more closely associated with the base of the coxa than is the trochantin of *Lepisma* (Fig. 17). The sclerites of *Machilis* are not as much like those of *Lepisma* as one might expect, and there are ample grounds for placing the *Machilis*-like forms in the order Protothysanura, distinct from the Thysanura (which would then contain only the *Lepisma*-like forms such as *Lepisma*, *Nicoletia*, etc.). The sclerites of *Machilis*, however, are as much like those of *Lepisma* as any other Apterygotan type, and the *Lepisma*-type apparently leads from the *Machilis*-like forms to the lower Pterygota.

I have pointed out that the Ephemerids and Odonata have retained the old primitive method of holding the wings out from the body when at rest (due to their inability to fold the wings along the abdomen) and that these two groups represent early offshoots of the old Palaeodictyopterous stock, so that one would expect that the sclerites of the Ephemerids and Odonata would present as many primitive features as any of the Pterygotan types. The Odonata, however, have become specialized along their own peculiar path of development, and the Ephemerids, even in their immature stages, are not as primitively organized as one would be led to expect.

The lateral cervical sclerites *lc* are very small in immature Ephemerids (Figs. 22, 26 and 31) and in this respect, they

resemble the nymphs of certain Plecoptera (Fig. 20) but this is the only feature that the Ephemerids and Plecoptera seem to have in common, and the sclerites offer practically no support for the view that the Plecoptera should be grouped with the Ephemerids and Odonata, as certain recent investigators are inclined to do, instead of placing the Plecoptera near the Embiids, where they properly belong. The cephaliger *cg* or head-bearing process of the neck plate *lc* is the only portion of it which is strongly chitinized and pigmented in the adult mayfly shown in figure 30, but the outline of the neck plate *lc* can be readily detected, and it is of much greater extent than is the case with the neck plates of the nymphal mayflies here shown.

The neck plates *lc* of the Odonata (Figs. 37 and 38) are well developed, and the cephaliger *cg* of the Odonatan shown in figure 37 is rather suggestive of that of the Ephemerid shown in figure 30, although the neck plates of the Odonata are much larger than those of the Ephemerids, and are rather different in outline. The posterior portion *pc* of the neck plate of the Odonatan shown in figure 37 is rather suggestive of the sclerite *pc* of the Embiid shown in figure 39—which is of a peculiar type, and I am at a loss to understand why Embiids and certain Odonata have some rather unusual anatomical features in common; but that this has any particular phylogenetic significance is doubtful. The anterior portion *cg* of the lateral neck plate of the immature Odonatan shown in figure 34 is rather odd, and possibly represents the detached cephaliger. The neck plate *lc* of the immature Odonatan shown in figure 34 is rather different from the neck plate of the corresponding adult shown in figure 37, and the adult exhibits certain peculiar ventro-lateral neck plates *j* not present in the immature form.

The precoxal bridge *pr* is not well developed in the immature mayfly shown in figure 22, and in the adult mayfly shown in figure 30 the precoxal bridge *pr* is incomplete and is very slender. In the mayfly nymph shown in figure 26, however, (compare also Fig. 31) there is a well developed precoxal bridge *pr* suggestive of that of the immature Odonatan shown in figure 34. A comparison of the adult Odonatan shown in figure 37 with its nymph shown in figure 34 would indicate that the simple precoxal bridge *pr* of the nymph (Fig. 34) becomes split along

much of its extent in the adult and the posterior portion resembles the trochantin to some extent, but as was previously mentioned, a comparison with the nymphal condition would indicate that the sclerite in question is a portion of the precoxal bridge.

In the mayfly nymph shown in figure 31, the trochantin *tn* is well developed, but in the other Ephemerids here shown the trochantin is greatly reduced or is lacking, and the Odonata do not exhibit any marked tendency toward the development of the trochantin. In the nymphal Odonatan shown in figure 34, the trochantin is represented by the small, rather indistinct sclerites labelled *tn*, and in the adult forms, the trochantin is almost completely atrophied.

The presternum is wanting in all of the mayflies and Odonata that I have examined, although the sclerite labelled *is* in the mayfly nymph shown in figure 22 may represent the presternum. It was the only mayfly in which I could find any trace of a sternal plate in front of the basisternum *bs* (the sternal region connected with the pleural region by a precoxal bridge), so that such plates must be rather rare in the mayflies. The basisternum *bs* and furcasternum *fs* are well demarked in the Odonatan shown in figure 37 and in the mayfly nymph shown in figure 26; and the furcal pits *fp* (or external manifestations of the internal processes forming the diapophyses or paired apophyses for muscle attachment, etc.) are quite large in both groups of insects. The mayfly nymph shown in figure 22 is the only Ephemerid I have seen in which the postfurcasternum *pfs* is present, but this sternal sclerite is rather characteristic of the Odonata, especially in the adult stages (see *pfs* of Figs. 37, 38 and 23). The spinal pit *sp* or external mark of the internal median unpaired process for muscle attachment (i. e. the spina or monapophysis) is readily found in the Odonata, but I have not been able to see it very clearly in any mayflies.

The pronotum *pn* tends to overlap the pleural region to some extent in the mayflies (Figs. 20 and 31), while in the Odonata the tendency is for the pronotum *pn* to unite with the pleural region (see Figs. 34, 37, etc.). In the mayfly nymph shown in figure 26, however, the pronotum tends to unite with the pleural region, as in the Odonata. The pronotal region of the Odonata

is divided into various areas by grooves, depressions, markings of various kinds, etc., and its surface is raised into various prominences, humps, and the like.

Although I have not studied a wide enough range of forms to know if the thoracic sclerites are of much value in the group Odonata, I would nevertheless call attention to the fact that the so-called "Anisozygopteran" *Epiophlebia* (Fig. 38) is astonishingly like the Anisopteran *Uropetala* (Fig. 37), and is quite different from the Zygopteran *Agrion* shown in figure 23, in the character of its thoracic sclerites; and even the contour of the pronotum *pn* is very similar in *Epiophlebia* (Fig. 38) and *Uropetala* (Fig. 37), while both pronotal contours differ very markedly from that of the Zygopteran shown in figure 23. Although the Odonatan types here figured include some of the most primitive forms, they have become too greatly specialized along their own paths of development to be of great interest from the phylogenetic standpoint, and I doubt that any living Odonata exhibit morphological features of much value for determining the original condition of the sclerites in the ancestral Pterygota. The same is true, to some extent, of the mayflies also, although the mayflies are rather suggestive of the ancestral Pterygota in certain of their abdominal structures.

Comstock and other recent investigators are inclined to group the Plecoptera with the Ephemerids and Odonata because all of these groups have acquatic nymphal stages. This is a most unfortunate arrangement, however, because the Plecoptera are not closely related to these groups at all, but are extremely closely related to the Orthopteroid group Embiidina. Palaeontology clearly shows that the Odonata and Ephemerids branched off from Palaeodictyoptera-like ancestors (through Protodonata and Protephemerida) before the Pterygota had developed the ability to fold their wings flat along the top of the abdomen, while the Plecoptera apparently branched off from Protoblattid-like ancestors (i. e. the common stem of the Protoblattids and Protorthoptera) which had already developed the ability to fold the wings along the abdomen (although such forms as the Synarmogoidea, which serve in a measure to connect the latter with the Palaeodictyoptera apparently had not yet developed this ability.) Every feature of importance in the

wings and body structures points to an extremely close relationship between the Plecoptera and the rest of the Orthopteroid insects, and it is to be feared that those who seek to group the Plecoptera with the Odonata and Ephemerida do not know the origin of the groups in question, and are likewise too unfamiliar with their anatomical features to give a well founded opinion as to their affinities.

. While the Plecopteran nymph shown in figure 20 is rather specialized in certain respects, it has retained several very primitive features suggestive of a derivation from ancestors resembling the Lepismatidae (Fig. 17) in some respects. Thus the large pronotum *pn* (Fig. 20) which bends downward over the pleural region is suggestive of that of the Lepismatid shown in figure 17, and the character of the sclerite *etn* of figure 20, which is of greater extent than the trochantin alone is suggestive of the eutrochantin of the Lepismatid. The same is true of the large sternal plate *bs* in figure 20, which overlaps the furcasternum *fs* to a much greater extent than is indicated in the drawing; and the lack of development in the neck plates of the Plecopteran nymph shown in figure 20 also suggests the operation of tendencies inhibiting the growth of the neck plates more or less completely in the Lepismatids. Indeed, the whole habitus of the Plecopteran nymph here figured is surprisingly "Lepismatoid," and the resemblance extends to many other features of the body as well (e. g. the head contour, antennae, cerci, etc.), so that the Plecoptera are in some respects very like the early types of Orthopteroid insects. Their nearest relatives are the Embiids, and I shall compare these two groups in discussing the evolutionary tendencies exhibited by the thoracic sclerites of the Orthopteroid insects in general.

The Plecopteran *Capnia* (Fig. 1) has as many well marked sternal subdivisions as any single insect I have seen. The anteriormost region *gul* is very faint and is almost indistinguishable (although it is well developed in certain other insects) but the six sternal subdivisions following it are easily seen. The sclerite *is* may have been formed by the deposition of chitin and pigment in the neck membrane, but the sclerite *ps* of figure 1 is probably a detached portion of the large plate *bs* behind it. In figure 2, the sclerite *ps* is still a portion of the plate *bs* though

it shows indications of becoming demarked from the latter, and in the primitive Plecopteran shown in figure 8, the region *ps* is even less demarked from the remainder of the plate *bs*, so that from the study of the Plecoptera and other forms, I have concluded that the presternum *ps* is a detached portion of the basisternum *bs*. In the Embiids (Fig. 39), the sclerites *is* and *ps* are rather like those of *Capnia* (Fig. 1). and in the Embiid shown in figure 39, the presternum *ps* is closely associated with the basisternum *bs* and appears to be a detached portion of the latter.

The basisternum *bs* of *Capnia* (Fig. 1) is connected with the pleural region by a precoxal bridge *pr* made up of a lateral extension *ls* of the sternite *bs* which meets a lateral extension *lp* of the pleural region. In the Plecopteran shown in figure 12, however, the remains of the precoxal bridge *pr* are apparently composed of an extension of the pleural region, or at any rate the precoxal bridge *pr* is attached to the pleural region rather than to the sternal region, as seems to be also the case in certain Dermaptera (Fig. 13, *ls*) termites (Fig. 66, *pr*) Ephemerids (Fig. 30, *pr*) and other Pterygota, although when the precoxal bridge is incomplete in the Apterygota (Figs. 24 and 25, *ls*) it is usually the portion attached to the sternum *bs* which persists. The precoxal bridge *pr* of the Embiid shown in figure 39 is somewhat like that of the Plecopteran shown in figure 12, and the general character of the basisternum *bs* and furcasternum *fs* of the Embiids is suggestive of a relationship to the Plecoptera. (Compare also the lines in the basisternum *bs* of the Plecopteran nymph shown in figure 36, with those of the Embiid shown in figure 35. The hugely developed spinasternum *ss* of the Embiids however, is more suggestive of that of other Orthopteroids such as the Phasmid type shown in figure 83, or even of the Mantid shown in figure 85, and probably denotes the operation of a tendency which did not strongly effect most of the Plecoptera.

The furcasternum *fs* of figure 2 is composed of two halves, but in *Capnia* (Fig. 1) the furcasternum *fs* is a single sclerite which tends to unite with the basisternum *bs*, and is connected with the pleural region by a postcoxal bridge *po*. The postfurcasternum *pfs* is distinct from the spinasternum *ss* in *Capnia* (Fig. 1)

and *Leuctra* (Fig. 2), but in *Eusthenia* (Fig. 8) the postfurcasternum *pfs* appears to be united with the spinasternum *ss*, if I have interpreted these areas aright. In the Plecopetron shown in figure 12, the basisternum, furcasternum, postfurcasternum and spinasternum unite to form a single plate, and there are various combinations of these sternal subdividions in different insects. Usually, however, the basisternum and furcasternum unite, while the postfurcasternum and spinasternum unite, forming two plates which are sometimes referred to as the eusternum and poststernum. The furcal pits *fp* (Figs. 1, 8, 12, etc.) or external manifestations of the internal apophyses for muscle attachment, are well developed in the Plecoptera, and they have apparently preserved the well developed furcal pits from a source similar to that from which the Ephemerids and Odonata derived their well developed furcal pits, but this does not indicate the same ancestry for the Plecoptera, Odonata, and Ephemerida.

The spinal pit *sp* is very large in the Plecoptera shown in figures 1, 2, 12, etc. This pit is always borne on the spinasternum, and it is the external manifestation of an internal median unpaired process called the spina or monapophysis which serves as the point of attachment for muscles from both prothorax and mesothorax, so that from the musculature one could not decide whether the first spinasternum is prothoracic or mesothoracic. In certain larvae (Figs. 90, 91, 92, etc.) and in the adult Orthopteroids shown in figures 95, 94, etc., the spinasternal area *ss* is very closely associated with the spiracle *spi* or the plates *s* etc., about it, and since embryology shows that the first spiracle is mesothoracic (i. e. it belongs to the segment behind it, instead of to the one in front) this might be taken to indicate that the spinasternum which is so closely associated with the mesothoracic spiracle, belongs to the mesothorax instead of to the prothorax—i. e. the spinasternum might be the first mesothoracic sternal subdivision instead of the posteriormost prothoracic subdivisions. I have always interpreted the spinasternum as the posteriormost of the sternal subdivisions, however, and until stronger proof to the contrary is forthcoming I prefer to consider the spinasternum as the hindermost sternal sclerite, and have followed this usage for the time being, at least.

The pleural sclerites of *Capnia* (Fig. 1) are rather like those of *Embia* (Fig. 39), but the neck plates of *Embia*, and particularly the peculiar posterior lateral cervical *pc* of figure 39, are extremely like those of the Orthopteron *Grylloblatta* shown in figure 65, and the pleural plates of the Embiids (Figs. 39 and 35) are very suggestive of those of *Grylloblatta* (Fig. 65), as is also true of the divisions of the pronotum etc., although this is not shown to advantage unless the pronotum be figured from the dorsal view. In fact, the Embiids have inherited much in common with the Grylloblattids and also with the Dermaptera, since all of these insects were descended from Protorthoptera-like forms in the common Protorthopteran-Protoblattid stem.

The dorsal neck plate *it* of *Capnia* (Figs. 1 and 18) is very like the dorsal neck plate *it* of *Zorotypus* shown in figure 67, and the general character of the sternal sclerite *bs* and the precoxal bridge connecting it with the pleural region, etc., is very similar in *Capnia* and *Zorotypus*, although the sternal sclerite *bs* of *Zorotypus* (Fig. 67) is more like that of *Grylloblata* (Fig. 65) and the termites (Fig. 66). The explanation for these complicated interrelationships is to be found in the fact that the common Protorthopteran-Protoblattid stem gave rise to the lines of descent of all of these forms under discussion, and the features they have in common were derived from this common source.

In taking up the consideration of the insects related to the roaches (i. e. the roaches, Mantids and termites) the real value of the study of the neck plates etc., becomes apparent, since the lateral neck plates in particular in these insects are remarkably similar, and they differ from the neck plates of other insects rather markedly. I shall speak of the roaches, Mantids and termites as the Blattid group (Panisoptera) in the following discussion; and in taking up the consideration of the neck plates in the Blattid group, the following points should be particularly noted: the neck plates tend to become divided into an anterior region *ec* bearing the head, and an intermediate region *ic* which is prolonged ventro-mesally till it approaches its fellow of the opposite side in the middle line of the neck region. In the roach shown in figure 27 and in the Mantid shown in figure 28, the sclerites *ic* do not quite touch in the middle line, but in the roach shown in figure 29 the sclerites *ic* touch,

and in the roach shown in figure 33 they are quite closely approximated, while in the termite shown in figure 66 the sclerites *ic* touch in the middle line, and in the termite shown in figure 57 they are quite closely approximated. The ventral sclerites *gul* and *is* are well developed in the roach shown in figure 33, but they are not always very distinct in the roaches, and in some of the Mantids, such as the one shown in figure 28, they can be seen upon close examination. In the termites, they have faded out in most cases.

In the roaches (Fig. 29) and termites (Fig. 66) the precoxal bridge *pr* is usually incomplete, but in the Mantids (Figs. 28 and 85) the precoxal bridge *pr* extends from the basisternum *bs* to the pleural region without a break. The presternum *ps* is present in figure 33 but in most of the Blattid group, the presternum is not developed. The basisternum *bs* is divided into two halves in the roach shown in figure 33, and the parts are more widely separated in the roach shown in figure 56, in which the halves of the basisternum *bs* are very suggestive of those of the termite shown in figure 57. In the termite shown in figure 66, however, the basisternum *bs* takes on the triangular outline suggestive of the basisternum *bs* of *Zorotypus* (Fig. 67) and *Grylloblatta* (Fig. 65), and this shape of the basisternum is more like that of the Plecopteran *Capnia* (Fig. 1) which has retained the parts in a rather primitive condition.

In the Mantids (Figs. 28 and 85) the furcasternum *fs* is rather narrow between the coxae, but the sternal region behind the coxae becomes very broad and is connected with the pronotum *pn*. The spinasternum *ss* becomes involved in the lengthening of the prothorax in these insects, and is hugely developed in some Mantids. In the pronounced development of the spinsternum *ss*, the Phasmids (Fig. 83) approach the Mantids (Fig. 85) and several features of the anatomy of the Phasmids are very suggestive of a derivation from ancestors resembling Mantids very closely.

In the roach shown in figure 56, the furcasternum *fs* is very indistinct and the spinasternum *ss* is largely represented by the isolated spinal pit. The condition exhibited by this roach indicates the presence of a tendency toward the reduction of the furcasternum *fs* which manifests itself in the termites (Figs.

57 and 66) and is carried over into other derived forms such as *Grylloblatta* (Fig. 65) the Zoraptera (Fig. 67) and such Holometabola as the primitive sawfly shown in figure 58. In fact, the series of modifications shown in figures 56, 57 and 58, while not representing an actual evolutionary series, approximates very closely the stages gone through in the derivation of the sawfly type.

In the roach shown in figure 33, the spinastrnum *ss* has lateral extentions very like those of the cricket shown in figure 32, and the roaches have many features suggestive of the ancestors of the Orthoptera. The spinasternum *ss* is frequently quite large in certain Orthopteroid insects, however, (Fig. 83) and no roaches seem to have a very greatly developed spinasternum, although the Mantids (Fig. 85) usually have it very well developed, and the Embiids (Fig. 39) share this tendency with the forms in question. The spinasternum *ss* tends to fuse with the furcasternum *fs* in the roach shown in figure 27, and the same tendency toward the fusion of the spinasternum *ss* and the furcasternum *fs* is exhibited by most saltatorial Orthoptera, in which the spinasternum rarely fades out instead of fusing with the furcasternum, when it is no longer present as a distinct sclerite.

In the roach *Periplaneta* (Fig. 43) there are two intertergites or sclerites *it* situated between the head and the pronotum, serving as points of attachment for certain muscles. It is possible that the sclerites homologous with these intertergites become transversely elongated and becoming approximated mesally form an intertergal plate *it* in the Neuropteran larva shown in figure 41. The intertergites *it* of the roach (Fig. 43) may represent the intertergites *it* of *Capnia* (Fig. 1) and *Zorotypus* (Fig. 67).

The Phasmids, earwigs, and saltatorial Orthoptera (including the non-saltatorial *Grylloblatta*) form an Orthopteroid group of insects descended from a common ancestry in the Protorthopteran-Protoblattid stem, and the termites resemble in many respects the common ancestors from which the Orthopteroid group arose. In the general character of the sternal plates *Grylloblatta* (Fig. 65) resembles the termite shown in figure 66 very strongly, and *Grylloblatta* is an extremely primitive representative of the

Orthopteroid group. The neck plates and pleural region of *Grylloblatta* (Fig. 65) greatly resemble those of the Embiid shown in figure 39, as was previously mentioned, and both Embiids and termites were apparently derived from ancestors in the common Protorthopteran-Protoblattid stem occupying a position very near the point of origin of the Grylloblattid line of development. The thoracic sclerites indicate very clearly that *Grylloblatta* does not belong with the Blattoid insects, as is maintained by many of those who have expressed an opinion as to its affinities. In the Blattoid insects, the lateral neck plates tend to meet in the midventral line, whereas the neck plates and other thoracic sclerites of *Grylloblatta* are not of this type, and indicate a relationship to the other Orthopteroid insects, as is also indicated by the character of the head capsule, maxilla, ovipositor, and numerous other anatomical details.

The members of the Orthopteroid group (other than the saltatorial Orthoptera) which resemble the Grylloblattids most closely in the character of their pleural plates, are such Dermaptera as the one shown in figure 13. In the earwig in question (Fig. 13) the eutrochantin becomes broken up into the trochantin *tn* and the sclerites *a* and *b*, homologous with the trochantin *tn* and the sclerites *a* and *b* of *Grylloblatta* (Fig. 65), and the earwig shown in figure 13 has a peculiarly formed pleural sclerite *cp* (compare also Fig. 1) homologous with the sclerite *cp* of *Grylloblatta* (Fig. 65), and many of the peculiarities of the earwigs are traceable in *Grylloblatta*, having descended to the two groups from their common ancestry. *Grylloblatta* is also very closely related to the Phasmids, but the relationships is not well shown by the sclerites, since the sclerites of the Phasmids are more like those of the Mantids than they are like those of *Grylloblatta* and the Dermaptera, and this might be taken to indicate that the Phasmids should be grouped with the Mantids rather than with the rest of the Orthopteroid group; but features other than the sclerites indicate a much stronger connection with the Orthopteroid group for the Phasmids. and it is preferable to leave them in the latter group.

As was mentioned above, the eutrochantin of certain earwigs (Fig. 13) becomes broken up into the trochantin *tn* and the sclerites *a* and *b*. The latter unite with the lower portion of the

pleural region, while the trochantin *tn* remains free, as in the earwig shown in figure 9. In figure 9, the lateral neck plate is divided into an anterior portion *ec*, an intermediate portion *ic* and a posterior portion *pc*, corresponding to the divisions of the lateral neck plate in certain roaches (Fig. 27) and termites (Fig. 66), and the lateral neck plates *lc* in all of the earwigs I have examined are divided into several sclerites. These plates have not been understood by most of those who figure the parts in earwigs, and some very fantastic interpretations have been applied to the parts.

In the earwig *Arixenia* (Fig. 9) the anterior sclerite *gul* is not firmly soldered to the underlip (as is the case with most earwigs) and when I labelled the figures of the earwigs, I supposed that the sclerites *gul* and *is* of *Arixenia* (Fig. 9) for example, might be the homologues of the sclerites bearing the labels *gul* and *is* in the roach shown in figure 33 (See also Figs. 91 and 99), and I was inclined to interpret the sclerite *ps* of the earwig shown in figure 9, as the presternum, as the labelling indicates. The sclerite *ps* of figure 9 however, is located in front of the inner angle of the neck plate *lc* (i. e. it occupies more the position of the intersternite *is* of other insects) instead of being situated behind this angle, as in the presternum of other insects, and upon maturer consideration I would now conclude that the sclerite labelled *is* and *ps* in figures 9, 7 and 13 should bear the labels *gul* and *is* instead, and the sclerite bearing the label *gul* in the earwigs would then be a type of gular sclerite not demarked in roaches etc.

The basisternum *bs* and furcasternum *fs* of the earwigs shown in figure 13 and 9 are peculiar in outline, and the furcal pits *fp* are located at the bases of the peculiar projections of the furcasternum extending toward the coxae. The whole make-up of the earwigs is so characteristic and peculiar that no one having any realization whatsoever of the value of comparative morphology would fail to recognize an earwig instantly by its peculiar sclerites. It is therefore most amazing that any entomologists today fail to recognize that *Hemimerus* (Fig. 7) is an out-and-out earwig, for it has every character of an earwig, and we must conclude that those who fail to see this are not sufficiently familiar with the patent facts of *Hemimerus*' anatomy

to enable them to form an opinion in the matter. Thus the sclerite *gul* in *Hemimerus* (Fig. 7) is attached to the underlip in the peculiar fashion of earwigs in general (Fig. 13, *gul*) and the sclerite *ps* has the characteristic shape of the sclerite *ps* in figure 13. The basisternum *bs* and furcasternum *fs* of *Hemimerus* (Fig. 7) are exactly like those of the earwig shown in figure 13, as is also true of the peculiarly shaped spinasternum *ss* in both earwigs. The very large trochantin *tn*, the peculiar sclerite *lp* and the large episternum *es* and epimerum *em* of *Hemimerus* (Fig. 7) are all of exactly the same type as the sclerites bearing the same labels in the earwig shown in figure 9; and all of the minutest details of *Hemimerus* proclaim it an earwig in such unmistakable terms that a confession of ignorance as to the affinities of *Hemimerus* is equivalent to a confession of ignorance of its anatomical details. *Hemimerus* thus offers a fine example of the value of the study of the thoracic sclerites in determining the closest relationships of insects whose affinities are not evident from a superficial examination, and it is to be hoped that the study of the sclerites will be given more consideration than has thus far been accorded them by entolomogists in general.

The general habitus of the earwigs is very suggestive of that of certain Plecopteran nymphs. In fact, the lines of descent of the Plecoptera, Embiids, termites, Mantids and Blattids seem to converge toward a common ancestral type in the Protorthopteran-Protoblattid stem, and the ancestors of the Phasmids, earwigs and true Orthoptera apparently sprang from a similar ancestry. While the Grylloblattids, which are at the bottom of the Orthopteroid group, are quite like the termites, and also resemble the Embiids, the Phasmids resemble the Mantids as much as any other forms, and the Dermaptera resemble the Embiids, Plecoptera, and Blattids among the primitive forms not yet advanced as much as the members of the Orthopteroid group.

The leaping Orthoptera (the other members of the Orthopteroid group) exhibit several developmental tendencies. The sclerites of the cricket shown in figure 94, for example, are extremely like those of the Phasmid shown in figure 95, in the character of the neck plates *lc* and the transversely extending

spinasternal region *ss*, which is closely associated with the sclerite *s* below the spiracle *spi*. While the cricket shown in figure 32 has a spinasternum *ss* like that of the roach shown in figure 33, the spinasternum *ss* of the cricket shown in figure 86, tends to become rather large and approach the Phasmid type (Fig. 95) in some respects. The tendency toward the overlapping of the pleuron by the pronotum (first noted by the writer in the study of the thorax of the grasshopper—see Crampton, 1918— and afterwards studied by DuPorte and others) which characterizes the leaping Orthoptera (Figs. 80, 81, 86, etc.) is also exhibited by the Phasmids (Figs. 95 and 83), and to some extent by the Mantids (Fig. 85); and the tendency toward the development of the slender precoxal bridge *pr* of the leaping Orthoptera shown in figures 80, 81, 86, etc., is also exhibited by the Phasmids (Fig. 83, *pr*) and certain Mantids (Fig. 85, *pr*). The neck plates *lc* of the leaping Orthoptera (Figs. 80 and 81) and Phasmids do not tend to meet in the mid-ventral line, and there is not a well marked tendency to develop the ventral neck plates *is*, *ps* etc., in the leaping Orthoptera and Phasmids, although these plates are well developed in most earwigs. In fact, the sclerites of the leaping Orthoptera are more like those of the Phasmids than they are like those of the Dermaptera, in most respects, and I think that the Phasmid line of development branched off at the base of that of the leaping Orthoptera, while the line of descent of the earwigs may have branched off a little further down, although in certain respects the earwigs are rather highly specialized. In fact, the earwigs have certain features very suggestive of the Blattids—but these were doubtless inherited from the common Protorthopteran-Protoblattid stem.

The Psocid group of insects comprises the Psocids, Pediculids (Anoplura), bird lice (Mallophaga) and Thysanoptera (thrips); and the members of this group were descended from ancestors resembling the Psocids, which in turn were derived from forms allied to the Protorthoptera and resembling termites in many respects. The Zoraptera, which are archaic Psocids, are among the most primitive representatives of the group, so that it is extremely important to study the anatomy and developmental tendencies exhibited by the primitive Psocid *Zorotypus* if we are

to attempt to determine the point of origin of the lines of descent of the other members of this group.

Unfortunately, my specimen of *Zoroytpus* is an extremely delicate one, and the parts are but feebly pigmented, so that in certain lights it is almost impossible to make out the outlines of the sclerites, particularly in the regions behind the basisternum *bs* of figure 67. On this account, and since I did not wish to break off the coxae in order to get a better view of the parts hidden by them, I was forced to guess at the outline of the sternal sclerites behind the basisternum *bs*, and in the following discussion I shall limit myself to the consideration of the sclerites which I could see more or less distinctly. The basisternum *bs*, the precoxal bridge *pr*, the pronotum *pn*, the intertergite *it* and other structures of *Zorotypus* (Fig. 67) are very suggestive of those bearing the same labels in *Capnia* (Fig. 1), and it would seem that the ancestors of *Zorotypus* were very like the termite-like forms from which the Plecoptera arose. The triangular outline of the basisternum *bs* of *Zorotypus* (Fig. 67) is suggestive of that of the basisternum *bs* of *Grylloblatta* (Fig. 65) and of the termite shown in figure 66, and I suspect that the furcasternum of *Zorotypus* is very like that of *Grylloblatta* (Fig. 65, *fs*) and the termites (Fig. 66, *fs*). *Zorotypus* (Fig. 67) is also very suggestive of the ancestors of the sawflies such as the one shown in figure 58, in the outline of its basisternum *bs* etc., but this resemblance is probably attributable to the fact that the ancestors of the sawflies and of *Zorotypus* were termite-like forms which exhibited features of this type.

Another very important Psocid is the interesting *Embidopsocus* shown in figure 70. This has developed the true Psocid features, while *Zorotypus* has retained too many primitive features to be a typical Psocid, although it is a member of the Psocid order. *Embidopsocus* (Fig. 70) has a broad basisternum *bs* with a furcasternum *fs* having the furcal pits *fp* rather widely separated and the spinasternum *ss* is quite large for a Psocid, resembling the Embiids (Fig. 39) in these features. The pronotum *pn* bears the epimerum *em* laterally, giving a peculiar appearance to the pronotum (compare also Fig. 39) which is also exhibited by *Atropus* (Fig. 10) and related forms, although I could not make out the parts very distinctly in my poorly preserved

material of *Atropus*. The sternum of *Atropus* (Fig. 10) appears to be rather broad like that of *Embidopsocus* (Fig. 70), but the pronotum of *Atropus* (Fig. 10) is inclined to become narrow. In the Psocid shown in figure 50, the pronotum *pn* is very narrow; the lateral cervical *lc* is rather peculiar, and is attached to the pleural region through the mediation of a smaller sclerite *pc* (the lateral cervical *lc* is also closely associated with the precoxal region *pr* in the Psocid shown in figure 70) and the sternal region is much reduced.

In the Mallophagan shown in figure 53, the sternal region is very like that of the Psocid shown in figure 50, as would be expected from the fact that the Mallophaga were descended from Psocid-like ancestors. The neck plates *lc* of the Mallophaga shown in figures 53 and 54, are as much like those of the Psocids (Fig. 50) as any, and the pronotum of these Mallophaga, and its relation to the pleural region, is rather suggestive of the condition exhibited by the Psocid shown in figure 70. The coxae of the Mallophaga are extremely elongated transversely and suggest an origin from Psocids somewhat like the one shown in figure 50. The sclerite labelled *ps* in figure 53 has been interpreted as the presternum provisionally, but I would not insist on this interpretation.

The Pediculids or Anoplura were descended from the Psocid-like forms which gave rise to the Mallophaga, and one would expect that the Anoplura would have certain characters in common with the Psocids and Mallophaga. The sclerites of the Anoplura which I have been able to examine, are so greatly modified and reduced that they are not of great value in a phylogenetic study of the parts. The sternal region of the Anopluran shown in figure 4 is rather suggestive of the sternal region of the Mallophagan shown in figure 53 and the Psocid 50, but the resemblance is not marked. The process interpreted as the lateral cervical *lc* in figure 4 is suggestive of the lateral cervical *lc* of the Hemipteron shown in figure 6, and the Mallophaga (Fig. 54); and in general, the parts resemble those of the Hemiptera and the Mallophaga as much as any. In the Anopluran shown in figure 5 the sternal region is somewhat like that of the Psocid *Atropus* shown in figure 10, and in general, the tendencies exhibited by the Anoplura and Mallophaga

would indicate that they had a common ancestry, from which the Mallophaga have departed less than the Anopluran have, while the Psocids resemble the ancestors of the Mallophaga and with the Hemiptera, they represent the ancestral stock as well as any known forms. From Psocid-like (or Hemiptera-like) forms were also derived the ancestors of the Thysanoptera, which resembled Protorthoptera in many respects.

The sclerites of the Thysanoptera are of two main types shown in figures 11 and 14. In the thrips shown in figure 14, the pronotum *pn* bears the episternum *es* and epimerum *em* in a fashion very suggestive of certain Psocids (Fig. 70) or Mallophaga (Fig. 53), and this backward migration of the pleural sclerites is much more pronounced in the thrips shown in figure 14 than in the one shown in figure 11. The large trochantin *tn* of the thrips shown in figure 14 is very suggestive of the large trochantin *tn* of the earwigs (Figs. 7 and 13), and I find a great deal in the Thysanoptera that is suggestive of a derivation from ancestors which resembled Dermaptera in many respects. The position of the sclerite *ls* in figure 14 is very suggestive of that of the sclerite *ls* of figure 13, but the sclerite *ls* in figure 14 is hugely developed, while in figure 13 it is small. The splitting of the basisternum *bs* and furcasternum *fs* in the thrips shown in figure 14 is rather suggestive of the condition occurring in some Hemiptera, but a divided basisternum and furcasternum also occur in some Blattids and Orthopteroid forms.

The sclerites of the thrips shown in figure 11 are a little more normal than those of the thrips shown in figure 14, but I have not as yet succeeded in obtaining the Thysanopterous types best suited for tracing the ancestry of the group. The union of the pleural region and pronotum in the thrips shown in figure 11 might indicate a tendency exhibited by the Psocids, or even by the Hemiptera, which exhibit many features in common with the Psocids and Thysanoptera, and have arisen from similar ancestors. The character of the furcasternum *fs* and the spinasternum *ss* of the thrips shown in figure 11 is rather suggestive of the Hemiptera, but the resemblance is not very striking. The ancestors of the Thysanoptera were doubtless Protorthopteroid forms related to the ancestors of the Psocids and Hemiptera.

The Hemiptera (including the Homoptera) were apparently derived from ancestors in the common Protorthopteran-Protoblattid stem, resembling the ancestors of the Psocids and Thysanoptera in many respects. Like the Psocids and Thysanoptera, the Hemiptera approach the sawflies and Neuroptera in certain evolutionary tendencies, and the complicated interrelationship is very puzzling. The Hemiptera which have retained the prothoracic sclerites in as primitive a condition as any are the Fulgorids (Fig. 73) and Cicadas (Fig. 69), although the Psyllids (Fig. 6) and even the Aphids (Fig. 98) have retained some primitive features. The general character of the parts in the Hemipteron shown in figure 69 is extremely suggestive of that of the parts in the Orthopteron shown in figure 68, and it would appear that the pronotum may grow down over the pleuron in certain Hemiptera (Fig. 73) in a fashion remarkably like that occurring in the Orthoptera. The trochantin *tn* of the Hemipteron shown in figure 69 is very suggestive of that of the Orthopteron in figure 68, and is also suggestive of the trochantin in the Coleoptera. The neck plates are always small and are frequently atrophied in the Hemiptera, and the neck plates *lc* of the Hemipteron shown in figure 69 is rather suggestive of that of the Mallophaga shown in figures 54 and 53 (compare also Fig. 68), just as the sclerite *lc* of the Hemipteron shown in figure 6 is suggestive of the sclerite *lc* of the louse shown in figure 4. The neck plate *lc* of the Hemipteron shown in figure 55 is rather like that of the Psocids (Fig. 50), and there is considerable resemblance between the Hemiptera, Psocids, Mallophaga and Anoplura. The slender sternal region *bs* and the furcasternum *fs* of figure 55 are somewhat like those of the Neuroptera and Hymenoptera etc., and the Hemiptera (and the Psocids) approach these forms in certain respects as was mentioned above. The Hemiptera seem to be a rather isolated group of insects, in which the thoracic sclerites suggest an origin in some ancestral type resembling the Orthopteroids, and in all probability the ancestors of the Hemiptera were some forms in the Protorthopteran-Protoblattid stem. The Hemiptera show affinities with the Psocids, Anoplura, etc., and their line of descent approaches that of certain lower Holometabola, as was mentioned above.

The sclerites of the Holometabola are of the utmost interest and importance from the standpoint of phylogeny, but they have been strangely neglected, and in many cases their homologies have been completely misunderstood. One of the most glaring cases is that of the Coleoptera, which from a rather aberrant group at the base of the Holometabolous stem, and since their sclerites differ somewhat from the typical condition, the interpretation of the parts has been completely misunderstood despite the fact that the sclerites are frequently used in the keys for classifying the members of this much studied group of insects. In order to understand the relations of the various parts to one another in the Coleoptera it is necessary to start with the more primitive types such as the Orthoptera, Mandids, etc., and observe the tendencies in these forms before attempting to interpret the tendencies exhibited by the Coleoptera.

If we compare the Orthopteron shown in figure 81, with the Orthopteron shown in figure 80, it should be evident to anyone that there is a tendency for the pronotum *pn* to grow down over the pleural region to the base of the coxa, thus covering practically all of the pleural region, but leaving visible the precoxal bridge *pr* extending to the sternal region largely composed of the basisternum *bs*, with which the furcasternum (marked by the furcal pits *fp*) is closely associated. The coxal cavities, or acetabula, are open behind (i. e. there is no postcoxal bridge connecting the sternal region with the pleuron), and this is apparently the primitive condition for the Coleoptera. By comparing the Coleopteron shown in figure 79, with the Orthopteron shown in figure 80 it is at once apparent that the pronotum *pn* in the Coleopteron (Fig. 79) has grown down over the pleural region as far as the line *x* on the precoxal bridge *pr*, and the nature of the sternal parts is practically the same in the two insects under consideration (Fig. 79 and 80). In figure 79, however, there is a trochantin *etn* which is not visible in the Orthopteron shown in figure 80 (although other Orthoptera have a trochantin) and the trochantin is worthy of especial mention in the lower Coleoptera, since it is a eutrochantin rather than a trochantin alone—i. e. it is of the nature of the sclerite *tn* together with the sclerites *a* and *b* in figure 13, for example.

It is easier to compare the parts of one of the lower Coleoptera such as the one shown in figure 83, with those of a Mantid, such as the one shown in figure 85, in attempting to explain the meaning of the parts in the Coleoptera and the Mantids are extremely like their ancestors in many respects. Thus, in the Mantid (Fig. 85) the furcasternal region *fs* is slender between the fore coxae *cx*, and the basisternum *bs* is connected with the pleural region by a slender precoxal bridge *pr* behind which is a eutrochantin *etn* with the typical suture and inner ridge in its posterior region. Similarly, in the primitive beetle shown in figure 82, there is a slender furcasternum *fs* with a basisternum *bs* connected with the pleuron-overlapping pronotum *pn* by a slender precoxal bridge *pr*, behind which is a eutrochantin *etn* with the typical suture and internal ridge in its posterior region. The pronotum *pn* has grown down over the pleural region as it has in the Orthopteron shown in figure 80, and as it has started to do in the Orthopteron shown in figure 81—and even the Phasmids (Fig. 83) show tendencies toward the down-growth of the pronotum, and subsequent overlapping of the pleural region by the pronotum. In the beetles shown in figures 79 and 84, the line *x* indicates the limit of the down-growth of the pronotum over the pleural region as far as the line *x* on the precoxal bridge *pr*, and the line *x* therefore serves as a very useful landmark in determining the interpretation of the parts in beetles, since the line *x* of figures 84 and 82 is evidently the line *x* of the Orthopteron shown in figure 80, and this point must be clearly understood if one is to interpret the parts aright in the Coleoptera.

In the beetles shown in figures 84 and 79, there is no marked ridge on the surface of the pleuron-covering pronotum *pn*, but in the beetle shown in figure 82 there is a notal carina *c* probably homologous with the humeral carina of saltatorial Orthoptera. In the beetle shown in figure 77*b*, there is an indication of the formation of a secondary suture *d*, below the ridge *c*, and the line *x* becomes more oblique, while a posterior downward prolongation *pp* of the pronotum meets an extension of the sternal region behind the coxa, to close the coxal cavity posteriorly. In the beetle shown in figure 76, the secondary suture *d* (which marks an infolding of the integument along this line)

is well marked, and another secondary suture *e* begins to form, and the suture *x* becomes more vertical. In figure 74, the suture *d* is well developed, and the suture *x* is continued posteriorly in the suture *e*, which becomes more pronounced, marking off in the inflexed sides of the pronotum the secondarily formed areas *psd* and *pp* which are erroneously interpreted as the prothoracic episternum and epinerum, and are usually referred to as the "*prosternal*" episternum and epimeron—whatever that may mean! The secondarily formed area *sn* is sometimes called the "epipleura," but this term is usually applied to the inflexed margins of the elytra.

The sclerites should offer evidence of considerable value in tracing the paths of development of the various Coleopterous families, but they have never been used in this way, and the anatomy of the groups has never been sufficiently well studied to enable most Coleopterists to realize that the Lampyroidea are the most primitive representatives of the order! A study of the sclerites would indicate that the Coleoptera were derived from ancestors related to the Mantids as well as the Orthoptera in the common Protorthopteron-Protoblattid stem, and while the Coleoptera are among the lowest representatives of the Holometabola, their line of development is a rather isolated one. Their nearest relatives among the lower Holometabola are the Hymenoptera and Neuroptera.

The sclerites of the Strepsiptera (Fig. 72) would indicate that the group is an offshoot of the Coleopterous stem, since the sclerites of the Strepsiptera are rather like those of the rhipiphorid shown in figure 71. There is some similarity between the sclerites of the Hemiptera (e. g. Fig. 73) and those of the Strepsiptera (Fig. 72) and the Hemiptera exhibit certain tendencies traceable in the Coleoptera also. These facts probably indicate that the Hemiptera arose from ancestors not unlike those of the Coleoptera, in the common Protorthopteron-Protoblattid stem, and the line of descent of the Hemiptera approaches that of the lower Holometabola in certain features, so that the Hemiptera thus resemble the Coleoptera in some respects, and also resemble the Strepsiptera which were derived from Coleoptera-like forebears.

The sclerites of the Neuroptera are of considerable interest, since the Neuroptera are among the most primitive representatives of the Holometabola, and some of them exhibit developmental tendencies which become more pronounced in the higher Holometabola, so that the Neuroptera serve to connect the higher with the lower forms, in many respects. The Neuropteron shown in figure 99 has the basisternum *bs* connected with the pleural region by a *broad* precoxal bridge *pr* and the Neuropteron shown in figure 52 has the basisternal region connected with the pleural region by a *narrow* precoxal bridge *pr* somewhat in the fashion of the Coleoptera Mantids and Orthopteroid insects, but many Neuroptera (Figs. 40 and 59) have no precoxal bridge, the sternal region being separate from the pleural region, as is the case with most higher Holometabola. The primitive Neuropteron shown in figure 97 exhibits an intermediate condition, in which the precoxal bridge *pr* touches the sternal region *bs*, but is not fused with it. The lateral neck plates *lc* are also produced transversely, and if they were to be produced until they met in the mid-ventral line, or if they united with a median presternal region, they would form a jugular plate such as the plate labelled *ju* in the neck region of the Neuropteron shown in figure 99. The jugular plate in the Neuropteron shown in figure 88 appears to be made up of the united lateral cervicals; but in some cases, a presternal region probably enters into the composition of the jugular plate. The postgular plate *gul* in figure 99 appears to be homologous with the postgular plate *gul* of figure 91, and possibly represents the transverse ventral sclerite gul of the roach shown in figure 33, in which the sclerite in question is rather loosely associated with the posterior portion of the underlip.

As was mentioned above, the tendency in all Coleoptera (Fig. 77*b*) is for the basisternum *bs* to be connected with the lateral regions by a precoxal bridge *pr* as in the Mantids and Orthopteroids; and some of the Coleoptera have the pronotum produced far ventrally on either side. In the Neuropteron *Mantispa* shown in figure 52, the sternal region *bs* is also connected with the lateral regions by a precoxal bridge *pr*, and the tendency for the sides of the pronotum to extend downward is so extreme, that the sides of the pronotum meet in the mid-

ventral line and fuse to form a peculiar tube-like stalk bearing the fore legs and head at its tip, the stalk being largely formed by the greatly elongated pronotum whose sides meet and fuse behind the sternal region in a most remarkable fashion. The chief point of interest in the sclerites of *Mantispa* (Fig. 52) however, is the fact that in it, the broad precoxal bridge *pr* of such Neuroptera as the one shown in figure 99, has become the slender precoxal bridge *pr* of figure 52, and the sternal regions *bs* and *fs* between the coxae have become slender and suggestive of the condition exhibited by the insect shown in figure 85. If the precoxal bridge *pr* of figure 52 were not developed, we would have a condition exhibited by the Neuropteron shown in figure 40, which is suggestive of the tendencies exhibited by the higher Holometabola shown in figure 42, or the series shown in figures 60 to 63.

In such Orthoptera as the one shown in figure 94, there is a tendency toward the reduction of the furcasternum *fs* and the precoxal bridge *pr* is greatly reduced, so that even in the Orthoptera-like ancestors of the Holometabola, there are exhibited tendencies which become more pronounced as the evolution of the Holometabola proceeds to the production of the higher types. I think that the condition exhibited by the Mantid shown in figure 85, however, furnishes a better starting point for tracing the modifications later met with in the Holometabola since in the Mantid shown in figure 85, the sternal regions *fs* and *bs* become narrowed between the coxae, and the basisternum *bs* is connected with the lateral region by a precoxal bridge *pr* as in the lower Coleoptera (Fig. 82) and in the Neuropteron shown in figure 52 (which leads up to the higher anatomical types) and also in the sawfly shown in figure 49, which is also of great interest in tracing the modifications met with in the higher forms—and the study of the sawflies and otherHymen optera is not only of value from the phylogenetic standpoint, but the parts are so misinterpreted in most cases, that they deserve especial mention at this point,

In such sawflies as *Cimbex* and related forms, the precoxal bridge is rather broad as is the case in the Coleoptera and other near relatives of the sawflies. In *Abia* (Fig. 49) however, the sternal parts are narrow (compare with Fig. 52 and Fig. 85)

and the precoxal bridge *pr* is also narrow, and is connected with the pleural region *es* behind the large cervical region *lc*, which is usually interpreted as a sternal plate, or as a part of the pleuron, or as anything but what it really is, namely a large neck plate associated with the pleural region! If anyone will glance at the sclerites in their primitive relations, as in figure 85 or figure 52, it will be at once apparent that the neck plates *lc*, which bear the head in all insects in which they are developed, *invariably occur in front of the precoxal bridge, pr*, which serves as a landmark in identifying the parts. Hence in the sawfly shown in figure 49 the sclerite *lc* which bears the head (as all lateral cervical sclerites do) and is situated in front of the precoxal bridge *pr* must be the lateral cervical plate and nothing else, as I pointed out long ago (Crampton, 1909) and as was also pointed out by Martin, 1916, who studied my material. No one else has paid the slightest attention to this fact, however, so that I may perhaps be pardoned for again giving the reasons for this interpretation which seems to me to be the only logical and tenable one, and those who interpret the sclerites in any other fashion should at least give some reason for disregarding all of the evidence which clearly demonstrates the homologies here given.

As was mentioned above, the lower Holometabola such as the Neuroptera exhibit two tendencies. One tendency is to develop a precoxal bridge *pr* connecting the narrow sternal region *bs* with the episternum *es* (and epimerum *em*) as in figure 52. Another tendency exhibited by the lower Holometabola is for the precoxal bridge to become atrophied, or remain undeveloped and for the large lateral cervicals *lc* (which bear the head) to become associated with the pleural sclerites *es* and *em*, as in the Neuropteron shown in figure 40 (the posterior portion of the lateral neck plate *lc* is actually attached to the episternum *es*, as is also the case in figure 97, but this is not well indicated in figure 40). The same tendencies are well shown in the Neuropteron shown in figure 59, and if we trace through the modifications exhibited by the series of insects shown in figures 42, 44 and 48, it should be at once apparent that the large head-bearing lateral cervical *lc* which become associated with the episternum *es* and obsolescent epimerum

em in figure 40, is the exact homologue of the large head-bearing lateral cervical *lc* which lies near the episternum *es* and obsolescent epimerum *em* in figure 42, while in figure 44 the large head-bearing lateral cervical *lc* begins to fuse with the episternum *es* and obsolescent epimerum *em*.

From the modifications mentioned above, it is but the merest step to the condition exhibited by the sawfly shown in figure 48, in which the large head-bearing lateral cervical *lc* becomes closely united with the episternum *es* and small epimerum *em*, and I cannot see how anyone can mistake these homologies. In the sawfly shown in figure 49, the union of the head-bearing lateral cervical *lc* with the episternum *es* is more intimate because of the disappearance of the suture between them (which is retained in the sawfly shown in figure 48) and the atrophy of the epimerum *em* is more complete in figure 49, although the epimerum *em* shows signs of becoming reduced to a small narrow marginal area in the insects shown in figures 40, 42, 44, 97 etc., and is apparently "on the way to extinction" even in these insects, so that it is perfectly comprehensible that the process of atrophy of the epimerum might be carried to the extreme in the insect shown in figure 49, which exhibits all of the tendencies cited above. We thus have in some sawflies, as in the one shown in figure 49 a tendency to develop the precoxal bridge *pr* as in the Neuropteron shown in figure 52, while other sawflies, such as the one shown in figure 48 (or in Fig. 58) there is a tendency for the precoxal bridge to become atrophied or to remain undeveloped and the sternal region is reduced between the coxae. The lateral cervicals *lc* bear the head as is the case in all other lateral cervical sclerites, but they tend to become prolonged ventro-mesally in the sawflies—a tendency which is exhibited as far back as the termites (Fig. 57), roaches (Fig. 33) and other forms related to the Protorthopteroid ancestors of the sawflies (see also Fig. 97) so that it need occasion no surprise that the sawflies and other Hymenoptera exhibit tendencies present in forms related to their ancestors. Thus, in the sawfly shown in figure 49, the lateral cervical region *lc* has begun to send down a ventro-mesal prolongation toward its fellow from the opposite side of the body, and in the sawfly shown in figure 48, the lateral cervicals *lc* almost touch

in the ventro-mesal line of the neck, as the lateral cervicals do in the lower forms, and it should be clearly understood that the lateral cervicals are the only sclerites which do this, so that there can be no question whatsoever as to the identity of these sclerites in the Hymenoptera.

In brief, the reasons for considering that the plates *lc* of the sawflies shown in figures 48, 49, etc., represent the lateral cervical sclerites are as follows: (1) the plates *lc* of figures 49, 48, etc., bear the head, as do the lateral cervicals of all other insects; (2) the plates *lc* of figures 49, 48. etc., are situated in front of the precoxal bridge *pr* as is the case with the lateral cervicals of other insects; (3) these lateral cervicals in the sawflies unite with the episternum and obsolescent epimerum as do the lateral cervicals in related Holometabola (Fig. 97); and (4) the plates *lc* of figures 49, 48, etc., approach each other in the median ventral line as do the lateral cervicals *lc* of the lower insects related to the ancestors of the sawflies (i. e. the termites shown in figure 57, etc., the roaches shown in figure 33, or the Neuropteron shown in figure 97) or as the lateral cervicals do in the higher Holometabola related to the sawflies (i. e. in the Lepidopteron shown in figure 62, in mosquitos etc.), so that there can be no escape from the conclusions that the sclerites *lc* of the sawflies shown in figures 49, 48, etc., represent the lateral cervicals.

If the lateral cervicals *lc* are recognized as such in the sawfly shown in figure 48, for example, it is then a very easy matter to identify the sclerites labelled *lc* in figure 47 of another Hymenopteron, *Scolia*, as being to all intents and purposes the lateral cervicals, despite the fact that these sclerites are usually incorrectly interpreted as the "sternum" in the higher Hymenoptera. The reason for this misinterpretation apparently lies in the fact that the lateral cervicals of the higher Hymenoptera become greatly enlarged, and are closely approximated ventrally, bearing a superficial resemblance to a sternal plate. The true sternum bearing the labels *bs* and *fs* in figure 47, is usually concealed by the coxae in the higher Hymenoptera, and the sternum is usually reduced to a narrow strip between the fore coxae in them, resembling in this respect the sterna of the insects shown in figures 44, 42, 40, 59, 58, 57, etc.

From the foregoing, it is evident that the Hymenoptera parallel the Neuroptera is exhibiting two principal modificational tendencies in the sternal and pleural regions. Thus in some of the Hymenoptera such as the one shown in figure 49 (compare also Fig. 52) there is a precoxal bridge *pr* connecting the sternal region with the pleural region (as in certain primitive Neuroptera, Coleoptera, Orthopteroids etc.), while in other Hymenoptera, such as the ones shown in figures 48, 58, etc., the precoxal bridge is lacking, and in such instances the lateral cervicals are usually greatly developed and tend to unite with the episternum and greatly reduced epimerum. The tendency for the sternum to become a very narrow region between the coxae, exhibited by such Neuroptera as those shown in figures 52, 59, etc., is likewise paralleled by such Hymenoptera as those shown in figs. 49, 48, etc., and this tendency is carried over into the higher Holometabola.

Although both Hymenoptera and Neuroptera exhibit tendencies carried still further in the higher Holometabola, and furnish us with forms illustrating the transition from the lower lower to the higher types, the Neuroptera are better "connecting links" between the lower and higher Holometabola than the Hymenoptera are, and in fact, it is very difficult to decide whether to group the Neuroptera with the lower or with the higher Holometabola. The lower Neuroptera are very like the Coleoptera (and Hymenoptera) in many respects, but the higher Neuroptera have so much in common with the Mecoptera, Trichoptera and other higher Holometabola, that I have provisionally grouped the Neuroptera with the higher Holometabola in the appended tables, although there is much to be said in favor of grouping the Neuroptera with the lower Holometabola. At any rate, the Neuropterous types shown in figures 59 or 40, make good starting points for the tracing of the modifications exhibited by the higher Holometabola shown in figures 60, 61, 62, 63, etc., and they would also make good starting-points for tracing the modifications exhibited by the Mecoptera shown in figures 42 and 44, although the Mecoptera have certain features suggestive of a relationship to the Hymenoptera as well.

The Mecoptera were apparently derived from Neuropteroid ancestors resembling *Sialis* in some respects and having certain anatomical details in common with the Hymenoptera. Thus the Mecoptera shown in figures 42 and 44 resemble the Hymenoptera in having the lateral cervical plate tending to unite with the pleural region while the epimerum becomes obsolescent; but exactly the same tendencies are exhibited by the Neuroptera shown in figures 40, 59, 97, etc., and the character of the pronotum and prosternum of these Neuroptera is much more suggestive of that of the Mecoptera than is the case when the Hymenoptera are compared with the Mecoptera.

The line of development of the Mecoptera leads almost directly to that of the Diptera, as is indicated by a host of anatomical features; but the evidence of the thoracic sclerites is perhaps the most striking for indicating a Mecopteroid ancestry for the Diptera. Thus, the sternum, bearing the labels *bs* and *fs*, the lateral cervicals *lc*, the episternum *es* and the epimerum *em*, etc., of the Mecopteron shown in figure 61, are startlingly like the sclerites bearing the same labels in the Dipteron shown in figure 60; and even the division of the pronotum into an anterior region *apn* and a posterior region *ppn* in the Dipteron shown in figure 60, is paralleled by a similar division of the pronotum into an anterior region *apn* and a posterior region *ppn* in the Mecopteron shown in figure 42. (Compare also Fig. 40). While it is possible that the Diptera were derived from Neuropteroid ancestors which likewise gave rise to the Mecopteran line of descent, it is more probable that the Diptera were derived from Mecopteroid ancestors (i. e. those resembling the Mecoptera in most respects).

The ancestors of the Trichoptera and Lepidoptera were undoubtedly very like the Neuroptera, but they may have been somewhat more Mecopteroid than Neuropteroid, judging from certain anatomical features which the Mecoptera have in common with the Trichoptera and Lepidoptera. At any rate, the Neuroptera have retained many features suggestive of the common ancestors of the Mecoptera, Trichoptera and Lepidoptera, and the lines of development of the Trichoptera and Lepidoptera parallel each other remarkably closely, as is indicated by the striking resemblance between the Trichoptera and Lepidoptera is numerous thoracic features as well as in other anatomical details.

When we compare the pronotum *pn*, the pleuron *es* and *em*, the trochantin *tn*, the lateral cervicals *lc* and the sternum *bs* and *fs* of the primitive Lepidopteron shown in figure 62 with the corresponding parts in the Trichopteron shown in figure 63, it is very difficult to believe that we are dealing with insects belonging to distinct orders, so great is the resemblance between the two, even in the minutest details. All of the features mentioned are remarkably similar in the two insects, but the most striking resemblance in structural details is to be found in the trochantin *tn* which has a peculiarly constricted distal region *dtn* in both insects, despite the fact that exactly this type of structure occurs in no other insect of which I have any knowledge (although a distitrochantin *dtn* of a slightly different character is formed in certain roaches such as the one shown in figure 27 etc.). The character of the sclerites would thus point to an extremely close relationship between the Lepidoptera and Trichoptera (as is also indicated by other anatomical features as well), and a comparison of the parts with those of such Mecoptera as the one shown in figure 61 would indicate that the common Lepidopteron-Trichopteron stem probably branched off from ancestral types resembling the Mecoptera, which in turn were derived from Neuroptera-like forebears resembling the Sialidae in some respects.

In the Lepidopteron shown in figure 87, the lateral cervicals *lc* are connected by a narrow transverse bridge *ps*, which is possibly homologous with the presternum or the intersternite. At any rate, a comparison with the Trichopteron shown in figure 89 would seem to indicate that the presternal region *ps* (Fig. 89) may become connected with the lateral cervicals *lc* by means of a transverse bridge, although it is quite possible that the region labelled *ps* in both figures 87 and 89 are merely modified portions of the lateral cervicals which have sent down meso-ventral prolongations which meet and form a narrow bridge connecting the two lateral cervicals. In fact, when one studies the Culicids, and such Diptera as the one shown in figure 93, there seems to be considerable evidence that the lateral cervicals may send down meso-ventral prolongations which meet and connect the lateral cervicals of each side. Provisionally, however, I have adopted the interpretations indicated by

the labellings, and the labels will also serve to indicate the homologies of the parts in the rest of the adult insects which cannot be discussed in detail at this time.

Since the thoracic sclerites have been of such great value in determining the interrelationships and lines of descent of the higher Holometabola, I had hoped that they might likewise aid in determining the origin and affinities of the fleas. The sclerites of the flea shown in figure 118, however, are of such a highly modified type that they offer no servicable clues for tracing the affinities of the Siphonaptera. The pronotum *pn* of the flea shown in figure 118 is situated far behind the base of the coxa *cx* which articulates far forward with a process on the anterior region of the pleural region which fuses with the united basisternum *bs* and furcasternum *fs*. This condition is somewhat suggestive of that exhibited by the Trichopteran larva shown in figure 114, but the resemblance is not very striking, and I have not succeeded in finding any insect in which the parts are strikingly similar to those of the Siphonaptera. The Siphonaptera have a metathorax as large and well developed as the mesothorax, and in this respect they differ from the Diptera, in which the metathorax is always reduced to a mere vestige in comparison with the mesothorax (even in apterous Diptera as well) and since certain fleas have a distinct mentum (or mental plate distinct from the rest of the labium) and labial palpi, composed of more than two segments, in addition to other features of a much more primitive nature than can be found in any Dipteron I know of, I am inclined to think that the fleas could not be derived from any known Dipterous type, and the Siphonaptera were probably descended from ancestors of a much more primitive character than any known Dipteron. These ancestors may have resembled Trichoptera or Mecoptera in certain respects, but I hardly think that they were Coleopterous, as some investigators would maintain. The most that can be said in the present state of our knowledge is that the fleas were probably descended from forms anatomically more primitive than the Diptera, and it is preferable to leave the further discussion of their origin and affinities until more is known of the anatomical details of all stages of the Siphonaptera.

Before leaving the subject of the interrelationships of the Holometabola, I would briefly summarize the evidences of relationship furnished by the sclerites of the larval forms. The retention of the spinasternum *ss* (which is closely associated with the sclerites *s* about the mesothoracic spiracle *spi*) in the Coleopterous and Neuropterous larvae shown in figures 90, 91 and 92, indicates a relationship to Orthoptera-like forebears resembling those of the Orthoptera shown in figures 94 and 95, for example; and the resemblance of the sclerites of a larval Neuropteron such as the one shown in figure 117, to those of the Coleopterous larvae—particularly in the pleural region of figures 117, 112, etc. (compare with Figs. 107, 90, etc.)—would indicate that the Neuroptera and Coleoptera are quite closely related (as is also indicated by a comparison of the mouthparts, etc., of the larvae in the two groups). Furthermore, the fact that the sclerites of a larva of *Corydalis*, for example, do not differ greatly from those of the corresponding adult stages, coupled with the fact that the head and mouthparts of a larval *Corydalis* are remarkably similar to those of the corresponding adult stage, would indicate that the Neuroptera are very primitive Holometabola, since the changes in structure from the larval to the adult stages are less marked in the most primitive Holometabola, and the amount of change in structure is an index of the primitiveness of the Holometabola under consideration.

The precoxal bridge, which is broad and continuous with the basisternum *bs* in the Neuropteron larva shown in figure 92, is a feature very suggestive of Coleopterous affinities, and the formation of a ventral jugular plate *ju* in the Neuropteran larva shown in figure 92 is also suggestive of tendencies exhibited by the Coleoptera, such as the larva shown in figure 107 which has a large jugular plate, but in this instance it is largely formed by the presternum *ps*, in figure 107, while in the Neuropterous larvae, the jugular plate is largely formed by the lateral cervicals.

The character of the jugular plate in the larval Coleopteron shown in figure 90, however, would indicate that the lateral cercivals *lc* enter into the formation of the jugular plate (bearing the labels *ps* and *lc* in figure 90) even in the Coleoptera.

A study of the parts in the primitive larval types shown in figures 90, 91, 92, etc. would indicate that there are three main regions of the prothorax in larval forms. The anteriormost region is the neck, containing the presternum *ps*, the lateral cervicals *lc*, and the intertergites (dorsally). The next region contains the basisternum and furcasternum *bs* and *fs* connected with the pleural region by precoxal and postcoxal bridges (or by membranous areas), and the pronotum. The hindermost region of the prothorax (or the anteriormost region of the mesothorax) is composed of the spinasternal region which is closely associated with the spiracular area and plates. These three regions may be further subdivided by creases or wrinklings of the integument; but the three regions mentioned are the most important.

The lateral cervicals *lc* are distinct in the beetle larva shown in figure 109, and they are closely associated with the pleural plate, thus suggesting that the lateral cervicals may be detached portions of the pleural plate, as was mentioned earlier in the discussion of the parts in *Machilis* and the Apterygota. The lateral cervicals *ls* are developed in the sawfly larvae shown in figures 105, 102, 103 and 104, and this may be taken to indicate that the Hymenoptera are rather closely related to the Coleoptera especially since the pronotal plates of such a sawfly larva as that shown in figure 105, are very suggestive of those of certain Coleopterous larvae. In other sawfly larvae, such as the one shown in figure 102, the pronotal sclerites are rather numerous, suggesting the beginning of tendencies toward the formation of numerous sclerites in the higher larvae such as the Lepidopteron shown in figure 101, for example; and the larvae of the sawflies in general, are better suited than the Neuropterous larvae are, to serve as starting-points for tracing the modifications occurring in the higher Holometabola. We must there-

fore take into consideration both sawflies and Neuroptera in tracing the origin and development of the higher Holometabola, although so far as the adult structures are concerned, the Neuroptera furnish the best starting-points for tracing the modifications exhibited by the higher Holometabola.

In the larval Mecopteron shown in figure 106, there is a well developed lateral cervical *lc* suggestive of the lateral cervicals of the larval sawflies, and the pronotum *pn* is rather suggestive of that of certain Lepidopterous larvae (Fig. 108) but the tendency toward the development of the lateral cervicals is apparently lost in most larval Lepidoptera. The spinasternum *ss* of the Lepidopteran larva shown in figure 108 is rather suggestive of that of the Trichopteran larva shown in figure 114, and the basisternum *bs* of the Lepidopteran larva (Fig. 108) is rather suggestive of the sternal region of the Trichopteran larva shown in figure 119, so that the parts of the larvae tend to bear out the evidences of affinities between the Lepidoptera and Trichoptera indicated by the structures of the adult insects.

The pronotum *pn* of the lower Lepidopterous larvae (Fig. 108) tends to remain in the primitive undivided condition, but in the higher Lepidoptera (Fig. 101) the pronotal region contains numerous sclerites suggestive of those of the sawfly larva shown in figure 102. The sawfly larvae thus exhibit tendencies similar to those exhibited by the larval Lepidoptera, in that the pronotal region may contain many plates or chitinized and pigmented areas, in the higher forms, while the lower ones have a pronotal region containing but few, or merely one sclerite. Despite the fact that in certain Collembola the pronotal region contains numerous sclerites, as was mentioned in the discussion of these insects, the presence of numerous sclerites in the pronotum of larval Holometabola can hardly be considered as the primitive condition for the Holometabola, since they were apparently derived from ancestors resembling the Blattoid or Orthopteroid insects, in which the pronotum is typically composed of one large sclerite, and I am inclined to regard this condition as the primitive one for the Holometabola as a group.

The labelling of the figures will serve to indicate the homologies of the parts in the other larval types here figured, so that it is not necessary to discuss them further at this time. Furthermore, the sclerites of the larval forms are apparently of less value than are those of the adults, for indicating the affinities and lines of development of the different orders, so that more space and attention have been given to the adult types in the present paper. The most interesting and important larval types, however, have been figured here, and it may be said that in the main the larval characters agree with those of the adults in indicating the origin and affinities of the various groups as set forth in the present paper.

The following table will serve to present in brief form the grouping of the different orders of insects indicated by a study of the mouthparts, thoracic sclerites and the terminal abdominal structures of female insects; and since the structures used are from widely separated, but typical portions of the body, the evidence they afford as to the evolution and affinities of the insectan orders should be sufficient to indicate the correct grouping of these insects, and I am confident that further additions to our knowledge of the verious structural, developmental, and other details, will serve to confirm the correctness of the groupings here indicated.

APTERYGOTA

I. PROTAPTERYGOTA

A. PANPROTURA

1. Protura (e. g. Eosentomon)
2. Eucinura (Collembola. e. g. Sminthurus, Entomobrya)

B. PANDICELLURA

3. Dicellura (e. g. Japyx, Campodea)

II. MESAPTERYGOTA

C. PANTHYSANURA

4. Protothysanura (e. g. Machilis, Petrobius)
5. Thysanura (e. g. Lepisma, Nicoletia)

PTERYGOTA

III. ARCHIPTERYGOTA

D. Pandictyoptera
- 6. Palaeodictyoptera (Fossil e. g. Stenodictya)
- 7. Palaeorthoptera (Fossil. Synarmogoidea)

E. Panarchiptera
- 8. Protarchiptera (Fossil. Protephemerida)
- 9. Archiptera (Ephemerida)

F. Pantyloptera
- 10. Prototyloptera (Fossil. Protodonata)
- 11. Tyloptera (Odonata)

IV. NEOPTERYGOTA

G. Panplecoptera
- 12. Protoplatyptera (Fossil. Hadentomoidea)
- 13. Platyptera (Embiids)
- 14. Plecoptera (Perlids)

H. Panisoptera
- 15. Protodictyoptera (Fossil. Protoblattids)
- 16. Dictyoptera (Mantids, Blattids)
- 17. Isoptera (Termites)

I. Panorthoptera
- 18. Protorthoptera (Fossil)
- 19. Orthoptera (Grylloblatta, Saltatoria)
- 20. Cheleutoptera (Phasmids)
- 21. Dermaptera (Forficulids)

J. Panhemiptera
- 22. Palaeohemiptera (Fossil)
- 23. Hemiptera (Homoptera and Heteroptera)

K. Panlipoptera
- 24. Protolipoptera (Zoraptera and Psocids)
- 25. Lipoptera (Mallophaga)
- 26. Ellipoptera (Anoplura, lice)
- 27. Thysanoptera (Thrips)

L. Pancoleoptera
- 28. Coleoptera
- 29. Strepsiptera (Stylopids)
- 30. Hymenoptera.

M. Panmecoptera
- 31. Neuroptera (Megaloptera and Planipennia)
- 32. Protomecoptera (Fossil e. g. Protomerope)
- 33. Mecoptera (Panorpids)
- 34. Prototrichoptera (Fossil. e. g. Belmontia)
- 35. Trichoptera (Phryganids)
- 36. Lepidoptera
- 37. Protodiptera (Fossil. e. g. Aristopsyche)
- 38. Diptera
- 39. Siphonaptera (Pulicids, fleas)

Superorders "G," "H," and "I," were formerly termed the Orthopteroid insects or Orthopteradelphia, while the superorders "J" and "K" were referred to as the Hemipteroid insects or Hemipteradelphia, and the superorders "L" and "M" were designated as the Neuropteroid insects or Neuropteradelphia. In order to bring these designations into harmony with the terms generally applied to some of the members of the groups in question, the Orthopteroid insects might be called the Paurometabola, while the Hemipteroid insects might be designated as the Parametabola, and the Neuropteroid insects would correspond to the Holometabola. This grouping brings together forms which are actually related and are descended from a common ancestry, although the members here assigned to the groups in question do not correspond in every case to those which are grouped together by certain other investigators.

The grouping of the superorders has been discussed in a paper by Crampton 1924, but the characters which serve to differentiate the above-mentioned groups in a general way (and with a few exceptions) may be mentioned again very briefly. In the preceding table, group "I" differs from group "II" in that the members of group "I" are entognathous, while the members of group "II" are ectognathous. Within group "I", the members of superorder "A" have not developed cerci, while the members of superorder "B" have developed cerci.

Among the Pterygota, the members of group "III" hold the wings outstretched in repose, while the members of group "IV" usually fold the wings along the top of the abdomen, or hold them roof-like above the abdomen, in repose. Within group "III," the superorders are differentiated as follows. The members of superorder "F" exhibit a "skewness" of the thorax, which does not occur in the members of superorders "D" and "E." Many of the members of superorder "E" have a median caudal filament or telofilum, while none of the members of superorder "D" as yet described have a telofilum.

Among the members of group "IV," superorders "G," "H," and "I" form a group of Orthopteroid insects (sensu lato) differing from the rest of the members of group "IV" in that most of them have distinct well developed parapodial plates or paraprocts; and practically all of them (excepting a few termites etc.) lack a well developed gular region. In the rest of the members of group "IV", the paraprocts are usually indistinct or wanting. Superorder "H" differs from the rest of the Orthopteroid insects in having the lateral cervicals approximated in the mid-ventral line (or the lateral cervicals approach each other in this region), while the members of superorder "G" differ from those of superorder "I" in that the members of superorder "I" are primitively ovipositor-bearing, while no known member of superorder "G" has a well developed ovipositor.

As to the other members of group "IV," superorders "J" and "K," which may be referred to as the Hemipteroid insects (sensu lato), differ from the members of the superorders "L" and "M" (which constitute the Holometabola or Neuropteroid insects) in that the Hemipteroids have a detached gnathorhabdon or rod-like structure resembling a detached lacinia of the maxilla, which is absent in the Holometabloa, and of course the Hemipteroids are not holometabolus. Among the Hemipteroids, the members of superorder "J" have the labial palp-approximated and fused to form the terminal portion of a beak for containing the remainder of the mouthparts, and most of these insects have pulvilliform structures between the claws while most of the members of superorder "K" lack such pulvilliform structures, and they do not have the labial palpi modified to form the terminal portion of a beak. Among the Neuropteroids or Holometabola, the members of superorder "L" do not have the mesothoracic coxae divided into a eucoxa and meron, while most of the members of superorder "M" have a meral region demarked from the rest of the mesothoracic coxae.

While the characters cited above will not hold good in every case without exception, they are sufficiently inclusive for practical purposes, and by using these characters, a fairly servicable key, giving a dichotomy in each case, may be constructed. I have not taken the space, however, to give such a key, nor have I included all of the fossil orders in the preceding table, since only those which have a direct bearing upon the ancestry of living insects have been considered. In a subsequent paper, I am hoping to give a key which will include all of the orders, both living and fossil, but since the present paper deals with the structures of living forms alone, it is unnecessary to treat of the fossil forms at this time.

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ABBREVIATIONS

The subscripts 1, 2, etc., denote that the structures in question belong to the prothorax or mesothorax.

a.....Postrochantin
ac.....Antecoxale
apn.....Antepronotum
b.....Intertrochantin
btn.....Basitrochantin
c.....Humeral or lateral carina of pronotum
cf.....Coxifer
cg.....Cephaliger
cp.....Curvipleurite
cx.....Coxa, or its location before removal
d.....Subnotal suture or fold
dtn.....Distitrochantin
e.....Postpseudopleural suture
ec.....Eucervicale
ecx.....Eucoxa
em.....Epimerum
ep.....Eupleurum
es.....Episternum
etn.....Eutrochantin
fp.....Furcal pits (furcacavae)
fs.....Furcasternum
gu.....Gula
gul.....Gulare in figures 7, 9 and 13. Postgula in other figures.
ic.....Intercervicale
ip.....Interpleurite
is.....Postgula in figures 7, 9 and 13
Intersternite in others
it.....Intertergite
j.....Juxtacervicale
ju.....Jugulare
lc.....Laterocervicale
lp.....Lateropleurum (parapleurum)
ls.....Laterosternum (parasternum)
m.....Dorsonotum
me.....Meron
mn.....Mesonotum
n.....Lateronotum
o.....Prespiraculare
oc.....Occipital condyle
p.....Precervicale
pc.....Postcervicale
pes.....Preëpisternum
pfs.....Postfurcasternum
pl.....Pleurum
pn.....Pronotum
po.....Postcoxale
pp.....Pseudopleurum
ppn.....Postpronotum
pr.....Precoxale
ps.....Intersternite in figures 7, 9 and 13. Presternum in other figures.
psd.....Pseudopleurum
r.....Postcoxal pit
rp.....Repugnipore
s.....Subspiraculare
sn.....Subnotum
sp.....Spinal pit (spinacava)
spi.....Spiracle
ss.....Spinasternum
t.....Prepleurite
tn.....Trochantin
x.....Precoxal suture or fold

EXPLANATION OF PLATES X–XVII

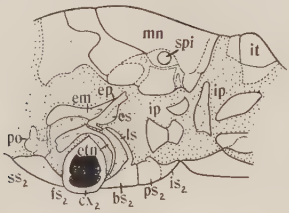
Figures 15, 16 and 18 represent lateral views of a segment. Figures 41 and 43 represent dorsal views of the neck plates. In other figures, unless otherwise stated, the sclerites are represented as though half of a segment had been split along the mid-dorsal line and the parts had been spread out in one plane. The missing identifications will be supplied later.

Fig. 1.—The Plecopteron, *Capnia* sp.
Fig. 2.—The Plecopteron, *Leuctra* sp.
Fig. 3.—The Hemipteron, *Aleyrodes* sp.
Fig. 4.—The Anopluran, *Haematopinus* sp.
Fig. 5.—The Anopluran, *Pediculus humanus.*
Fig. 6.—The Hemipteron, *Psylla* sp.
Fig. 7.—The Dermapteron, *Hemimerus talpoides.*
Fig. 8.—The Plecopteron, *Eusthenia spectabilis.*
Fig. 9.—The Dermapteron, *Arixenia* sp.
Fig. 10.—The Psocid, *Atropos* sp.
Fig. 11.—The Thysanopteran.
Fig. 12.—The Plecopteron.
Fig. 13.—The Dermapteron, *Echinosoma* sp.
Fig. 14.—The Thysanopteron.
Fig. 15.—Mesothorax of the Proturan, *Eosentomon* sp.
Fig. 16.—Prothorax of the Thysanuran, *Machilis* sp.
Fig. 17.—The Thysanuran, *Lepisma* sp.
Fig. 18.—Prothorax of the Plecopteron, *Capnia* sp.
Fig. 19.—The Collembolan.
Fig. 20.—Nymph of the Plecopteron, *Pteloperla* sp.
Fig. 21.—The Collembolan.
Fig. 22.—Nymph of the Ephemerid.
Fig. 23.—The Odonatan, *Agrion* sp.
Fig. 24.—The Proturan, *Eosentomon,* sp.
Fig. 25.—The Dicelluran, *Heterojapyx victoriae.*
Fig. 26.—Nymph of the Ephemerid.
Fig. 27.—The Blattid, *Blaberus* sp.
Fig. 28.—The Mantid, *Stagmonantis carolina.*
Fig. 29.—The Blattid, *Periplaneta americana.*
Fig. 30.—The Ephemerid.
Fig. 31.—Nymph of the Ephemerid, *Oniscigaster* sp.
Fig. 32.—The Orthopteron.
Fig. 33.—The Blattid.
Fig. 34.—Nymph of the Odonatan, *Uropetala* sp.
Fig. 35.—The Embiid, *Embia* sp.
Fig. 36.—Nymph of the Plecopteron.

Fig. 37.—The Odonatan, *Uropetala caravei.*
Fig. 38.—The Odonatan, *Epiophlebia.*
Fig. 39.—The Embiid, *Embia major.*
Fig. 40.—The Neuropteron.
Fig. 41.—The Neuropteron.
Fig. 42.—The Mecopteron, *Chorista australis.*
Fig. 43.—The Blattid, *Periplaneta americana.*
Fig. 44.—The Mecopteron, *Panorpa lugubris.*
Fig. 45.—The Neruopteron, *Coniopteryx* sp.
Fig. 46.—The Dipteron, *Hippobosca* sp.
Fig. 47.—The Hymenopteron, *Scolia bicincta.*
Fig. 48.—The Hymenopteron, *Dolerus* sp.
Fig. 49.—The Hymenopteron, *Abia* sp.
Fig. 50.—The Psocid, *Psocus* sp.
Fig. 51.—The Neuropteron, *Chrysopa perla.*
Fig. 52.—The Neiropteron, *Mantispa* sp.
Fig. 53.—The Mallophagan.
Fig. 54.—The Mallophagan.
Fig. 55.—The Hemipteron, *Coccus* sp.
Fig. 56.—The Blattid, *Diaphaneroptera* sp.
Fig. 57.—The Isopteron, *Leucotermes flavipes.*
Fig. 58.—The Hymenopteron, *Xyela* sp.
Fig. 59.—The Neuropteron, *Nemoptera sinuata.*
Fig. 60.—The Dipteron, *Limnophila macrocera.*
Fig. 61.—The Mecopteron, *Nannochorista dipteroides.*
Fig. 62.—The Lepidopteron, *Sabatinca* sp.
Fig. 63.—The Trichopteron.
Fig. 64.—The Neuropteron, *Climacea* sp.
Fig. 65.—The Orthopteron, *Grylloblatta campodeiformis.*
Fig. 66.—The Isopteron, *Syntermes grandis* (soldier).
Fig. 67.—The Psocid, *Zorotypus hubbardi.*
Fig. 68.—The Orthopteron, *Tettix.*
Fig. 69.—The Hemipteron, *Cicada.*
Fig. 70.—The Psocid, *Embidopsocus* sp.
Fig. 71.—The Coleopteron, *Rhipiphorus* sp.
Fig. 72.—The Strepsipteron, *Xenos* sp.
Fig. 73.—The Hemipteron.
Fig. 74.—The Coleopteron, *Harpalus caliginosus.*
Fig. 75.—The Dermapteron, *Forficula auricularia.*
Fig. 76.—The Coleopteron, *Dytiscus* sp.
Fig. 77a.—The Coleopteron, *Silpha* sp.
Fig. 77b.—The Coleopteron, *Hydrous triangularis.*
Fig. 78.—The Coleopteron, *Staphylinus* sp.
Fig. 79.—The Coleopteron, *Meloe triangularis.*

Fig. 80.—The Orthopteron, *Tridactylis atratus.*
Fig. 81.—The Orthopteron, *Gryllacris* sp.
Fig. 82.—The Coleopteron, *Lampyris* sp.
Fig. 83.—The Phasmid, *Phasma* sp.
Fig. 84.—The Coleopteron, *Atractocerus.*
Fig. 85.—The Mantid, *Mantoidea.*
Fig. 86.—The Orthopteron, *Gryllus domesticus.*
Fig. 87.—The Lepidopteron, *Papilio* sp.
Fig. 88.—The Neuropteron, *Raphidia* sp.
Fig. 89.—The Trichopteron.
Fig. 90.—Larval Coleopteron.
Fig. 91.—Larval Coleopteron, *Pyrrochroa* sp.
Fig. 93.—Larval Neuropteron, *Raphidia* sp.
Fig. 93.—The Dipteron, *Johannsenomyia* sp.
Fig. 94.—The Orthopteron, *Oecanthus* sp.
Fig. 95.—The Phasmid, *Phyllium* sp.
Fig. 96.—The Dipteron, *Tabanus atratus.*
Fig. 97.—The Neuropteron, *Sialis* sp.
Fig. 98.—The Hemipteron, *Aphis* sp.
Fig. 99.—The Neuropteron, *Corydalis cornutus.*
Fig. 100.—Larva of the Lepidopteron, *Zeuzera pyrina.*
Fig. 101.—Larva of the Lepidopteron, *Porthetria dispar.*
Fig. 102.—Larva of the Hymenopteron.
Fig. 103.—Larva of the Hymenopteron, *Megaxyela* sp.
Fig. 104.—Larva of the Hymenopteron.
Fig. 105.—Larva of the Hymenopteron, *Neurotoma* sp.
Fig. 106.—Larva of the Mecopteron, *Panorpa* sp.
Fig. 107.—Larva of the Coleopteron, *Calosoma sycophanta.*
Fig. 108.—Larva of the Lepidopteron, *Hepialis* sp.
Fig. 109.—Larva of the Coleopteron.
Fig. 110.—Larva of the Coleopteron, *Dytiscus* sp.
Fig. 111.—Larva of the Coleopteron, *Hydrophilus* sp.
Fig. 112.—Larva of the Neuropteron.
Fig. 113.—Larva of the Coleopteron, *Lampyris* sp.
Fig. 114.—Larva of the Trichopteron.
Fig. 115.—The Dipteron, *Anisopus punctatus.*
Fig. 116.—The Dipteron, *Midas clavatus.*
Fig. 117.—Larva of the Neuropteron, *Ithone* sp.
Fig. 118.—The Siphonapteron, *Ctenocephalus* sp.
Fig. 119.—Larva of the Trichopteron.
Fig. 120.—Larva of the Trichopteron.

CRAMPTON—NECK AND PROTHORACIC SCLERITES



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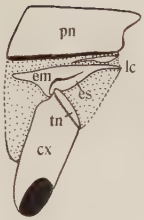

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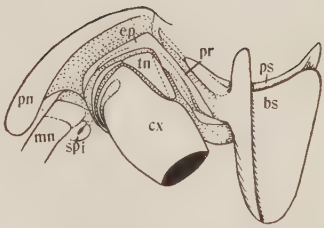

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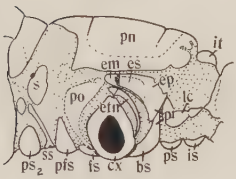

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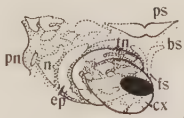

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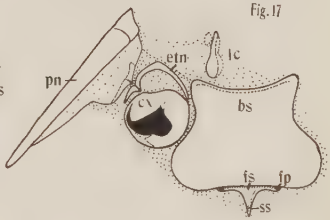

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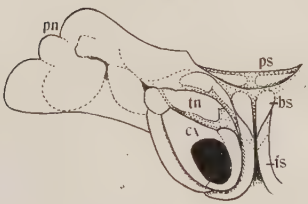

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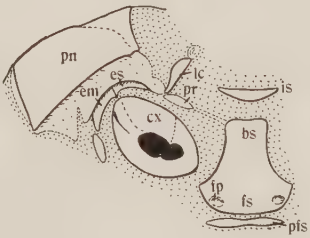

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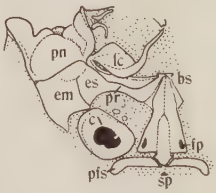

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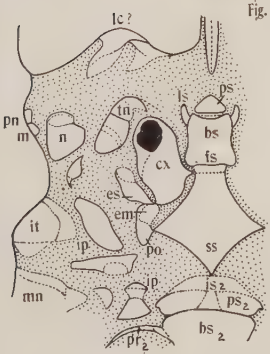

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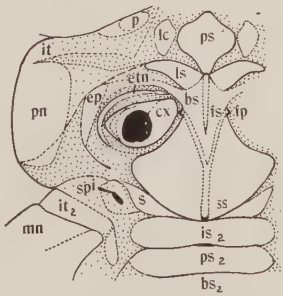

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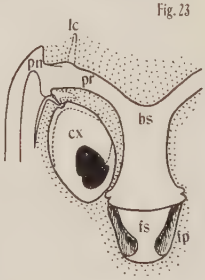
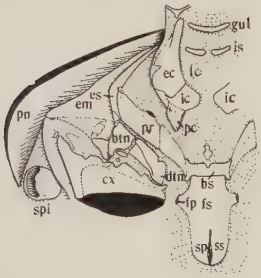


Fig. 26

CRAMPTON—NECK AND PROTHORACIC SCLERITES



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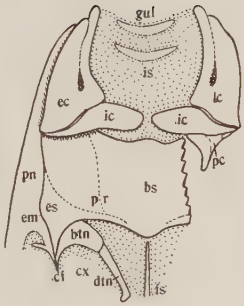

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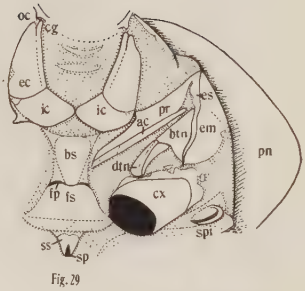
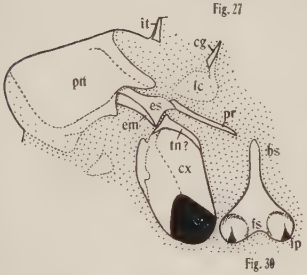


Fig. 29



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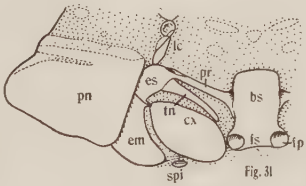


Fig. 31

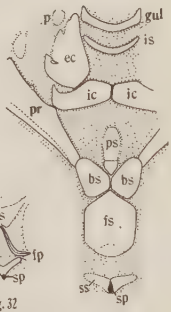


Fig. 33

Fig. 32

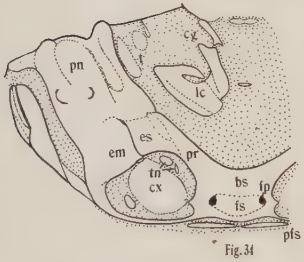
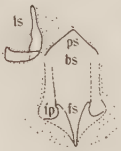


Fig. 34

Fig. 35



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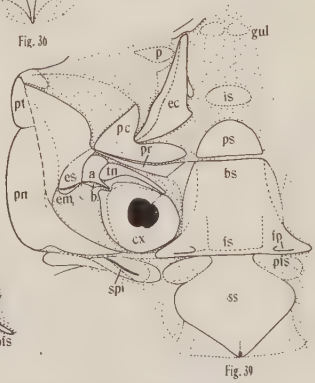

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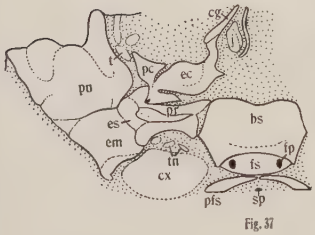


Fig. 37

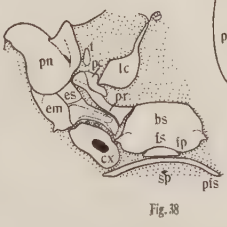


Fig. 38

CRAMPTON—NECK AND PROTHORACIC SCLERITES

CRAMPTON—NECK AND PROTHORACIC SCLERITES

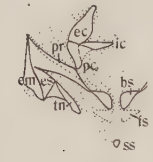
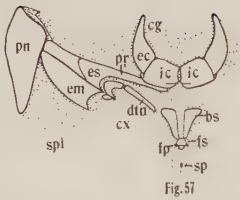


Fig. 56



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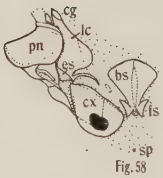

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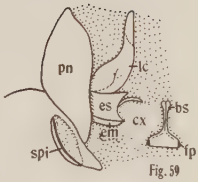

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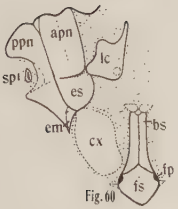

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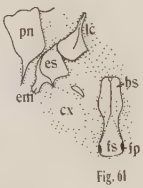

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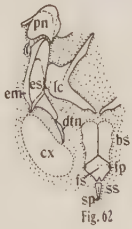

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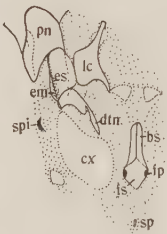

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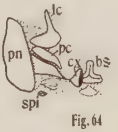

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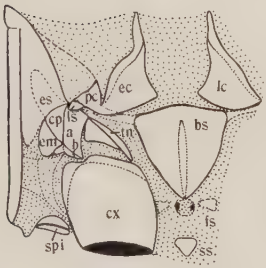

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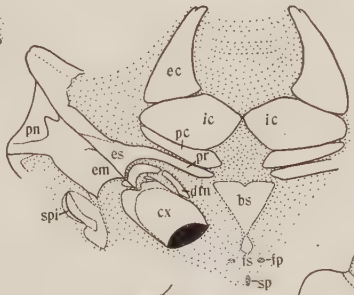

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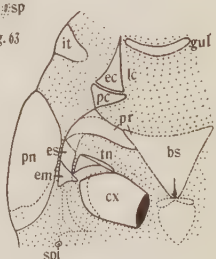

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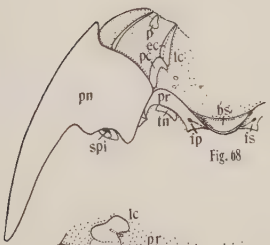

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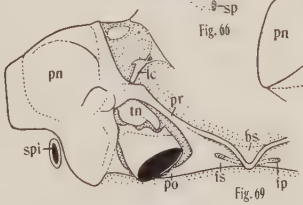

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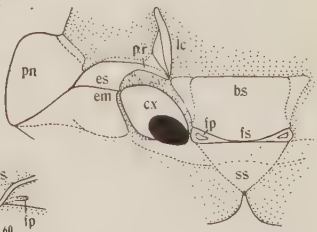

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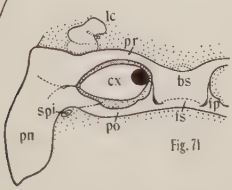

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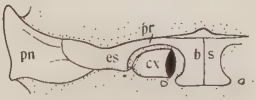


Fig. 72

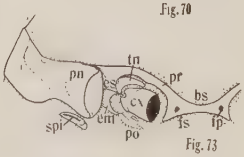
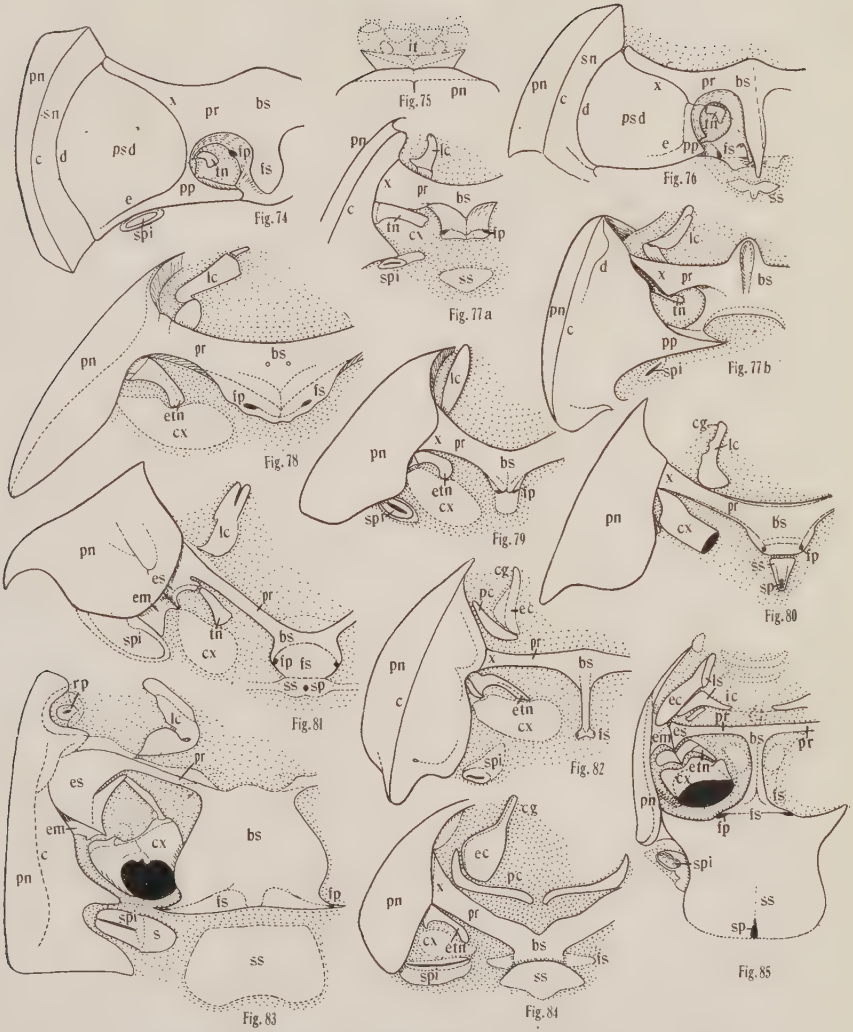


Fig. 73

CRAMPTON—NECK AND PROTHORACIC SCLERITES



CRAMPTON—NECK AND PROTHORACIC SCLERITES

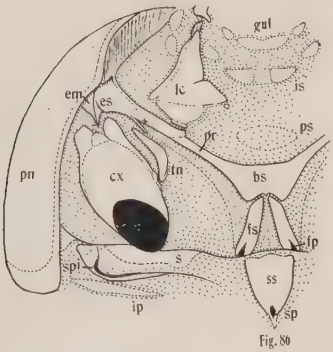


Fig. 86

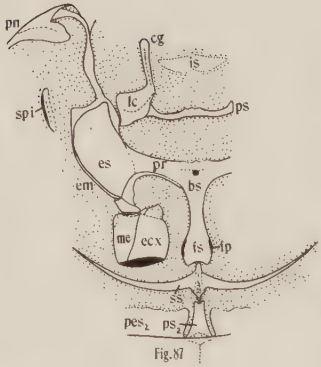


Fig. 87

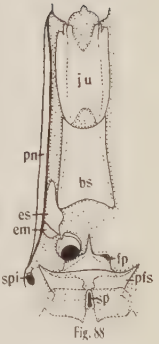


Fig. 88

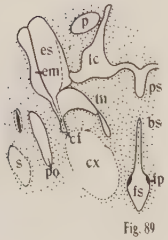


Fig. 89

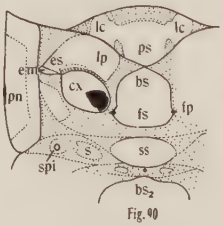


Fig. 90

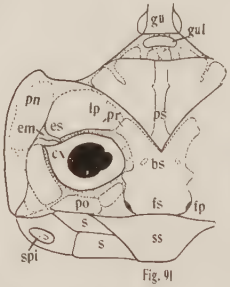


Fig. 91

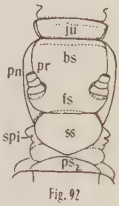


Fig. 92

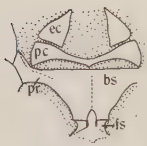


Fig. 93

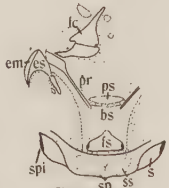


Fig. 94

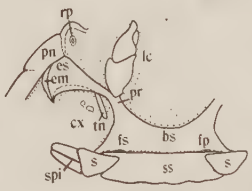


Fig. 95

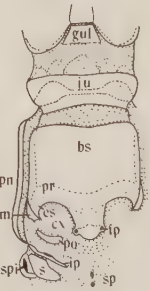


Fig. 99

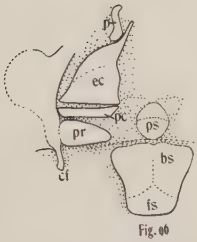


Fig. 96

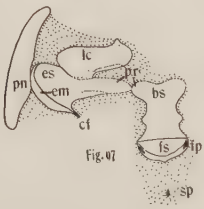


Fig. 97

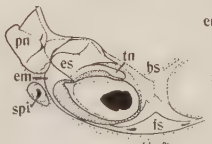


Fig. 98

CRAMPTON—NECK AND PROTHORACIC SCLERITES

CRAMPTON—NECK AND PROTHORACIC SCLERITES

DESCRIPTIONS OF NEW GENERA AND SPECIES OF DIPTERA (EPHYDRIDAE AND MICROPEZIDAE)

BY E. T. CRESSON, JR.

EPHYDRIDAE[1]

Gymnopa bidentata new species

Averaging larger than *tibialis*, more shining on the mesonotum, and the face is destitute of the usual silvery vesture except in the foveae; parafacial with two irregular pollinose depressions opposite antennae (in *tibialis* there is one large depression here); fifth abdominal segment somewhat densely scabrous on the dorsum but such area not sharply defined; fore and hind tibiae black except extremities. The micro-mount of the genitalia of these two forms show considerable differences.

Type.—Male; Saltair, Utah, July 1908, (J. M. Aldrich), [A. N. S. P., No. 6318]. *Paratypes.*—Eight males, 4 females; topotypical.

In the facial and abdominal characteristics this species simulates *subsultans* of Europe, but that species is more shining, with scarcely any sculpturing on the frons so that the areas are not well marked, the mesonotum is but sparingly pruinose, and the tibiae are entirely black.

This species has been confused with *tibialis*, and some of my early determinations for that species from Utah and California may prove to belong here.

Athyroglossa tectora new species

In the serial arrangement of the mesonotal setulae (an abnormal characteristic for species of this genus) and the similarity to *ordinata* Becker in other respects, is very noteworthy. It differs from that species in having the mesonotum almost opaque with brown and whitish dusting; the arista is long haired and the wing veins are distinctly clouded.

Black; halteres, fore tarsi except two apical segments, middle and hind tibiae and tarsi except two apical segments of latter, yellow. Shining to polished; mesonotum, scutellum, mesopleura and dorsum of abdomen, rather densely white to brown

[1] For other pertinent papers see Ent. News, xxxv, p. 159; xxxvi, p. 165.

pruinose. Wings hyaline with veins, especially posterior crossvein, clouded. Head as in *ordinata*. Arista with five long hairs. Mesonotum convex; setulae in distinct series, numerous in the dorsocentral but few in the acrostichal series, and some scattered setulae in the intraalar region. Scutellum convex, broader than long. Abdomen elongate; third and fourth segments subequal; fifth shorter. Legs as in *ordinata*. Wings shorter, but venation similar. Length, 2.5 mm.

Type.—Male?; Peru, South America, (H. A. Parish; 1914), [U. S. N. M., No. 28266].

Discomyza u-signata new species

Black; antennae, apices of palpi, tarsi except apically, yellow; halteres white; wings hyaline, with costal and marginal cells and a cloud over middle of posterior crossvein, brown.

Frons with broad orbital areas shining, metallic tinged, irregularly wrinkled; face weakly sculptured, shining, marked with white pollinose lines as follows: foveal spots, two median lines running parallel from antennae to near epistoma thence diverging, a laterally inclined nearly closed U-shaped mark surrounding each bristle; facial orbit and oral margin narrowly pollinose. Mesonotum and scutellum shagreened with submettallic olivaceous tinge, and suggestion of three darker mesonotal lines. Abdomen with slight granulose vesture. Length, 3.5 mm.

Type.—Female; San Antonio, Texas, April 8, 1908, (F. C. Pratt), [U. S. N. M., No. 29455]. *Paratypes*.—Two males; topotypical.

Psilopa unica new species

Similar to *Psilopa pulchripes* Loew but with the basal segment of fore tarsi white, the following four black.

Type.—Male, San Bernardino, Paraguay, February, 1906, (Barbarczy), [Hungarian National Museum Collection.]

Ditrichophora canifrons new species

Allied to *Notiphila calceata* Meigen (a European species also occurring in North America) differing in having a dense gray vesture on the frons and mesonotum, and whitish wings.

Black; parafacials, antennae except apex of third segment, palpi, bases and apices of tibiae, entire tarsi, tawny. Halteres yellow. Wings lactaceous. Opaque cinereous, with face, pleura and legs, somewhat shining black. Face rather flat with weak foveae; parafacials and cheeks, linear. Second costal section twice as long as third. Length, 2.5 mm.

Type.—Male; Jack Run, Allegheny County, Pennsylvania, June 4, 1908, (Cresson), [A. N. S. P., No. 6301]. *Paratypes.*—Four males, 5 females; topotypical.

Discocerina neiveifrons new species

This is apparently a typical member of the genus, but differs from the more typical species in being entirely shining black except the densely silvery cinereous frons.

Black; halteres white; all tarsi except their apices, tawny. Wings hyaline with brown veins. Shining species; frons opaque with anterior half, in the male and the narrow anterior margin in the female, silvery; posterior orbits, lower occiput, humeri, pleura, femora and tibiae more or less dusted with gray. Face polished with metallic tinge; mesonotum, scutellum and dorsum of abdomen, sparingly dusted with brown.

Frons quadrate; proclinate and reclineate frontals in alignment with the anterior ocellus; anterior silvery part, in male, somewhat flattened. Face one-half as broad as vertex, twice as long as broad; carina weak; three to four bristles on each side; parafacials narrow, bare. Cheeks as broad as length of second antennal segment; arista with four hairs. Abdomen rather slender, elongate. Second costal section twice as long as third; second vein straight or slightly curved at tip. Length, 2.5 mm.

Type.—Male; Parramatta, New South Wales, Australia, (Biro, 1909), [A. N. S. P., No. 6311]. *Paratypes.*—Eight males, 2 females; topotypical.

Allotrichoma lasiocercum new species

The fan-like male genital appendages is the outstanding characteristic of this species; the females not being distinguished from those of *Discocerina simplex* Loew. The latter is the common eastern member of this genus, the type of which I have seen in the Museum of Comparative Zoology.

Black; apex of middle tibiae, basal three segments of middle and hind tarsi, pale; halteres white. Opaque, gray; mesonotum, upper margin of mesopleura, and dorsum of first to third abdominal segments, more brownish, but not dark brown. Frontalia showing black through the sparse brown pollen, leaving orbits and ocellar region somewhat lighter; face golden medianly; tubercle appearing shining but not black Fourth abdominal segment not noticeably cinereous. Torma opaque, concolorous with lower part of face.

Dorsocentral series of about ten setulae. Genitalia, of type specimen, exerted as a cylindrical fifth and sixth segments, one-half the length of fourth segment, at the apex of which are the lateral appendages, with dilated, ciliated base and dilated, fan-like apex, the latter bearing about twelve long hairs. Length, 2.25 mm.

Type.—Male, Berkeley Hills, Alameda County, California, April 11, 1908, (Cresson), [A. N. S. P., No. 6319]. *Paratypes.*—Two females; topotypical. These are associated with the male, merely on account of their topographical habitat. They are slightly darker above than the male, but have no apparent characteristics by which they can be separated from those I have determined as *simplex* Loew.

Allotrichoma atrilabris new species

In this species the torma is shining black, in strong contrast with the opaque, gray face, and the mesopleura are brown along the upper and lower margins. In these respects the species differs from all previously described forms. In addition the species averages smaller than the others (1.8 to 2 mm.) and the appendages of the male genitalia are not visibly exerted.

Type.—Male; Lansdale, Montgomery County, Pennsylvania, July 12, 1908, (Cresson), [A. N. S. P., No. 6320]. *Paratypes.*—Two males, one female; topotypical.

Allotrichoma yosemite new species

This is apparently the western representative of *atrilabris*, and may prove to be merely a variety of that species. It, however, seems very constant in a few characteristics, particularly in the darker, nearly black, upper surfaces of the male, with only the ocellar triangle brownish, and in the dark tarsi, which latter are not noticeably paler basally; the face is brownish tinged above.

Type.—Male; Yosemite Valley, California, May 22, 1908, (Cresson), [A. N. S. P., No. 6321]. *Paratypes.*—One male, eight females; topotypical.

Allotrichoma lacteum new species

Black; halteres white; apex of tibiae and all trsi, yellow. Wings immaculate, lactaceous with pale veins. Opaque; frons except orbits blackish, the triangle hardly differentiated; lunule whitish; face dark brown with orbits lighter; cheeks, occiput, pectus and venter of abdomen, densely cinereous. Mesonotum, scutellum and dorsum of abdomen, brownish. Femora gray to brown.

Structurally similar to *lasiocercum*. Face one-third as broad as vertex, twice as long as broad; cheeks as broad as third antennal segment; arista with six to seven hairs. Hypopygium similar but the genital segments more exerted in the type.

Type.—Male; Bill Williams Fork, Arizona, August, (F. H. Snow), [Kansas University Collection]. *Paratypes*.—Two males, one female; topotypical.

Atissa atlantica new species

Very similar to the European *A. limosina* Becker, but the posterior crossvein is not clouded. It differs from *Allotrichoma litoralis* Cole, 1912 (also a member of the genus *Atissa* but which, upon comparison with European specimens, proves to be *Atissa hepaticoloris* Becker, 1903), in having the mesonotal setulae in four, not six, distinct series.

Black; halteres and base of tarsi, pale; antennae pale but somewhat infuscated above; halteres white. Opaque, dark brown, with face, cheeks, occiput, pleura, abdomen, and femora, cinereous. Wings immaculate, grayish, with dark veins. Face as broad as long; concave, in profile, with prominent epistoma; bristles in very short series. Cheeks one-half as broad as third antennal segment. Antennae situated on center line of eyes. Mesonotal setulae in four well separated series. Second costal section longer than third. Length, 1.2 mm.

Type.—Male; Wildwood, New Jersey, July 18, 1908, (Cresson), [A. N. S. P., No. 6302]. *Paratypes*.—Two males, one female; topotypical.

Atissiella mabelae new species

Opaque black; for the most part densely brown pruinose. Antennae except upper margin, yellow; halteres white. Wings grayish, with fuscous, nebulous spots as follows: one over each crossvein, two on third vein traversing first posterior cell, one in second posterior cell, and a large one in anal cell. Face, cheeks, occiput below, humeral spot, and lateral apical spots on third and fourth abdominal segments, cinereous. Mesonotum with anterior margin, two median vittae, and lateral margins, lighter brown. Scutellum concolorous. Abdomen more shining than mesonotum. Legs entirely black.

In general characteristics, similar to *setulosa* Cresson (from Costa Rica). Frons broader than long. Face distinctly carinate above, apparently transversely convex medianly and retreating below; upper bristle dorsolaterally curved, distinctly

removed mesally; obliquely laterad of same is a strong, ventrolaterally curved bristle, and two similarly curved setulae above; also a mesally curved bristle near oral margin. Cheeks narrow, scarcely as broad as third antennal segment, with one strong bristle. Third antennal segment rotund, large; arista with five long hairs. Mesonotum with four distinct, widely separated, series of minute, subequal setulae. Wings with second costal section distinctly shorter than third. Length, 1.25 mm.

Type.—Female; Swarthmore, Pennsylvania, October 19, 1908, (Cresson), [A. S. N. P., No. 6303].

This pretty, easily recognized species I name after Mabel S. Cresson. The wing maculation is very characteristic.

Atissiella setulosa also occurs in North America. Before me is a specimen collected at Swarthmore, June 19, 1910.

Atissa kairensis Becker, described from Egypt, also belongs to the genus *Atissiella.*

PELIGNUS new genus

Allied to *Atissa,* differing in having the facial profile convex, with the carina and foveae distinct; the ocellar bristles anterior to the line of anterior ocellus; post-ocellars well developed; facial bristles as in *Atissa* but the series more oblique, not parallelling the oral margin.

Genotype:—*Atissa durrenbergensis* Loew, which species also occurs in Utah. Specimens before me from that locality cannot be distinguished from those I have from Europe.

Ochthera circularis new species

Black; halteres tawny; palpi brown; fore and middle tarsi brown. Very similar to *O. rotunda* Schiner. Frontal orbits with cinnamon stripe. Face and cheeks broader than length of third antennal segment; face with bicuspidate median tubercle; torma elongate and sharply triangular. Mesonotum and scutellum granulose, bronze color, with yellow pruinose spot at submedian sutural indentations, and also at dorsal base of scutellum. Abdomen of olivaceous tinge, with lateral cinereous, marginal spots; fifth segment with complete, broad, cinereous apical band. Fore tibial spur about as long as basal segment of tarsi; the latter in the male much dilated, with the apical flexor tooth bearing about three, long, curved, hairs, and basad of tooth on posterior side there is a circular indentation. Length, 4 to 5 mm.

Type.—Male; Takao, Formosa, July 7, 1907, (Sauter), [A. N. S. P., No. 6304]. *Paratypes*.—One female; topotypical [A. N. S. P.], 1 male; Tainan, Formosa, February, 1909, (Sauter), [Hungary Nat. Mus.], 1 female; Buitenzorg, Java, (Bryant & Palmer), [U. S. N. M.], 2 females; Island of Penang, Philippine Islands, (Baker), [Dr. Bezzi].

Ochthera pilosa new species

Black; fore and middle tibiae, brown; halteres yellowish. Of aeneous to metallic silvery lustre, with shining surfaces somewhat obscured by grayish white dust; face, cheeks, and lower occiput densely silvery, or with yellowish tinge; face with fine black dots at bases of the scattered hairs; the prominence, subgibbous, not merely convex, nor tuberculous, without bare area above. Mesonotum shining, the setulae developed into short pile which becomes longer posteriorly and on scutellum. Abdomen broad, rotund; lateral margins rounded but not turned under as ventral lobes; cinereous, becoming denser laterally; segments two to four with apical brown marginal bands attenuating laterally, interrupted medianly; fifth segment with two brown spots. Fore tibial spur very short, one-third as long as basal tarsus. Length, 5 mm.

Type.—Female; Alamogordo, New Mexico, May 1, 1902, (Viereck and Rehn), [A. N. S. P., No. 6305].

Ochthera triornata new species

Black; fore coxae and all trochanters, yellow; apices of middle and hind femora, middle tibiae, bases of fore and hind tibiae, and apex of fore tarsi, tawny; halteres whitish. Wings brownish hyaline with pale veins.

Structurally, very similar to *O. regalis* Williston, differing in the limitation of the sublateral facial stripe to the lower convex portion of the face. In *regalis* this stripe is scarcely separated from the orbital stripe, and the median area is distinctly sculptured. Not so in the present species except in a concavity above the epistoma. Mesonotum micro-rugulose, somewhat shining, metallic bronze and coppery tinged, with indistinct sublateral aeneous stripe anteriorly. Length 3.5 mm.

Type.—Male; San Luis, Paraguay, (Reimoser), [A. N. S. P., No. 6306]. *Paratype*.—Female; San Bernardino, Paraguay, (Babarczy), [Hungary Nat. Mus.].

Hydrina binotata new species

Similar to *nitida* Fallen, in the absence of the black pleural spot but differing in having gray mesonotal stripes, and the white wing spots large, the latter assuming an S-shape design around the crossveins.

Black; third antennal segment below, apex of palpi, legs except femora and tibiae medianly, and apex of tarsi, pale. Halteres white. Wings brownish with whitish S-shape design around both crossveins. Shining with faint brown dusting. Frontalia opaque anteriorly. Face and cheeks cinereous. Mesonotum with humeri and dorsal stripes cinereous; pleura concolorous, with two mesopleural brownish stripes, but without velvety black spot. Scutellum velvety black laterally. Abdomen somewhat subopaque dorsally becoming polished apically. Length, 2 mm.

Type.—Male; Berkeley Hills, Alameda County, California, April 20, 1908, (Cresson), [A. N. S. P., No. 6312]. *Paratype.*—Female; topotypical.

Hydrina corona new species

This species is easily recognized by the appendiculated second vein.

Black; lower half of third antennal segment, palpi, legs except femora and tibiae medianly, and tarsi apically, pale. Halteres whitish. Wings brownish with two large whitish areas separated by a large brownish area which includes the two crossveins; the distal whitish area somewhat lunular in shape with the convex side towards apex of wing. Opaque, gray to brownish pruinose. Vertex and two occipital spots gray. Face yellowish with narrow white orbits. Cheeks and lower occiput gray. Mesonotum brown with four spots and humeri, gray. Pleura gray with two brown mesopleural spots; no velvety black spots except on lateral margins of scutellum. Abdomen subopaque, becoming polished apically. Length, 2 mm.

Type.—Male; Swarthmore, Delaware County, Pennsylvania, July, 1908, (Cresson), [A. N. S. P., No. 6313]. *Paratypes.*—One female, topotypical; 1 male, Swarthmore, June 26, 1910, (Cresson; along shady creek).

Hydrina pruinosa new species

Very similar to *corona* but third antennal segment rather discoidal, not longer than broad; cheeks broader; scutellum without velvety black lateral margins; wings with faint whitish areas in discal and second posterior cells; second vein without appendage. Legs with less infuscation.

Type.—Male; Mesa Grande, Sonoma County, California, May 1908, (P. C. Baumberger), [A. N. S. P., No. 6314].

Lytogaster extera new species

Black except base of tarsi somewhat brownish. Halteres knob sordid. Wings immaculate, hyaline; veins dark. Frons smooth, polished; face white pollinose except the polished median tubercle; cheeks and occiput purinose. Thorax shining, weakly, microscopically sculptured; pleura gray pruinose below. Scutellum distinctly micro-scabrous. Abdomen elongate, minutely roughened, dorsally; dorsum not noticeably flattened. Length, 2 mm.

Type.—Male; Trenton, New Jersey, August 21, 1910, (H. S. Harbeck), [A. N. S. P., No. 6315.]

Lytogaster furva new species

Somewhat similar to *L. pallipes* Cress,. described from Costa Rica, but the scutellum is narrower, flat, and granulose, giving it an opaque appearance.

Black; antennae except upper margin of third segment, palpi, all of fore legs except apex of tarsi, base and apex of middle and hind tibiae, and base of tarsi, tawny to yellow. Halteres with blackish knob. Wings immaculate, hyaline; veins pale. Shining to polished; scutellum densely granulose, appearing opaque. Abdomen minutely and densely punctured on dorsum of second and third, less on fourth segments. Face unevenly cinereous; orbits silvery; cheeks, and pleura below sparingly, cinereous. Face narrow, twice as long as broad; upper orbits nearly parallel. Third antennal segment much longer than broad, rounded apically or slightly angled above. Scutellum flat, subquadrate. Second costal section more than half as long as third; ultimate section of fourth vein four times as long as preceeding. Length, 1.5 mm.

Type.—Male? Beaverkill, Sullivan County, New York, July 6, 1909, (E. T. Cresson, Jr.) [A. N. S. P., No. 6317].

Canace nudata new species

This species differs from *nasica* and *snodgrassi* in the absence of any acrostichal bristles or setulae. It also occurs in Hawaii.

Black; halteres whitish. Opaque; upper surfaces black, somewhat brownish tinged. Face and cheeks gray; pleura, pectus, venter of abdomen, and femora, tinged with grey; wings brownish with dark veins.

Eyes oblique; cheeks one-third height of eyes; mesofrontal plate bare anteriorly. Antennae separated by not more than width of third segment. Face slightly angularly concaved in profile. Mesonotum bare except the usual macrochaetae and some setulae above humeri; no acrostichals nor setulae between the dorsocentrals. Length, 3 mm.

Type.—Male; Los Angeles County, California, February 28, 1915, (M. C. Van Duzee), [A. N. S. P., No. 6307]. *Paratypes.*—Two males, 10 females; topotypical.

MICROPEZIDAE.

The study of material of this family kindly loaned to me by the United States National Museum, the Bishop Museum, the American Museum of Natural History, Cornell University, and the New York Zoological Society, has resulted in the proposition of the new genera and species herein described. These will be incorporated with the described, and probably other undescribed, genera and species studied, in a contemplated revision of this family.

Telostylus philippinensis new species

This species differs from *binotatus* mainly in the possession of the large, opaque black supraalar spot and the shining one above fore coxae; and differs from *decemnotatus* in lacking the black sternopleural spot. These two species may be only varieties of *binotatus*, but more extensive study will be necessary to establish such synonymy.

Yellow, with black marks as follows: velvety spot laterad of antennae, the narrow shining frontal orbits, velvety ocellar spot, two shining postorbital spots, apex third antennal segment, superhumeral spot, a large opaque supraalar spot, a small presutural spot, a shining spot above fore coxae, apex of femora, and entire tibiae and tarsi. The entire frons, narrow facial orbits, and several areas on mesonotum are silvery when seen from in front. Arista white plumose with black base. With the exception of the mesofrons and antennae, the entire insect is shining to polished. Wings yellowish, becoming more intense towards costa. Head one and one-half to twice as long as high. Length, 5 mm.

Type.—Female; Limay, Bataan, Philippine Islands, (R. C. McGregor), [U. S. N. M., No. 29456]. *Paratype.*—One female; topotypical.

Chaetonerius comperei new species

The type of this species was determined by Coquillett as *Nerius lineolatus* Wied., but Wiedermann's description calls for pale preapical rings on the hind femora of which there is no trace in the present specimen.

Blaek; arista, frons except anterior lateral angles, posterior orbital spot, face, cheeks, notopleural stripe, middle of scutellum, two abdominal stripes, halteres, venter and hypopygium, pale; tibiae mostly pale brown. Mesonotum with broad median gray stripe, suggesting trifurcation anteriorly.

Head twice as long as high, posterior orbital area extensive, equalling one-quarter horizontal diameter of eye. Frons extending to base of antennae; no lunular callus; two frontals. First antennal segment globose; second one-half as long as first; third as long as first and second together, pointed, with white pubescent apical arista. Thorax as long before the wings as distance from wings to hind coxa; four pairs of dorsocentrals. Scutellum with four marginals. Legs slender; fore femora strongly setulose on anterior flexor, not spinose. Posterior crossvein about perpendicular to fifth vein. Length, 5 mm.

Type.—Male; Colombo, Ceylon, (C. Compere), [U. S. N. M. No. 27055].

Telostylinus bivittatus new species

This species differs from *lineolatus* as follows: Frons with two black vittae diverging from before ocellar tubercle to lateral anterior frontal margin. Face infuscated; palpi likewise apically. Antennae with first, second, and upper part of third segments, brown. Mesonotum with two narrow median and a broad sublateral stripe, brown; two dorsocentrals. Abdomen brown with two pale stripes. Femora with a distinct oblique subapical pale ring. Length, 7 mm.

Type.—Female; Buderim Mountain, Sidney, New South Wales, December, 1889, [U. S. N. M., No. 27057].

Gymnonerius dimidiatus new species

Distinguished from *fuscus* by the pale pleura and pectus as contrasted with the upper part of the thorax.

Black; face, cheeks, occiput below line of buccal orbits, thorax below notopleural suture, lower part of first antennal segment, halteres, and fore coxae, pale yellow or whitish; second and third antennal segments yellow, darker on upper margin; palpi pale; fore and middle trochanters, brown. Wings uniformally yellowish. Shining to opaque, depending on amount of gray or

whitish dust which is rather dense on the pale parts of thorax. Structurally similar to *fuscus*. Length, 12 mm.

Type.—Male; Los Banos, Philippine Islands, 1916, (F. X. Williams), [Bishop Museum, Collection]. *Paratypes*.—One male, one female; topotypical.

The pleura may be darker in some specimens but always lighter than the mesonotum, at least in the amount of the whitish vesture.

NIPPONERIUS new genus

This genus is proposed for the reception of *Nerius femoratus* Coquillett,[2] which species I cannot locate in any genus known to me nor is it mentioned in Enderlein's revision. It is a Neriini, and is apparently allied to *Odontoscelia* Enderlein. Before me is a female paratype of this species from Japan, (Mitsukuri), [U. S. N. M.].

Head twice as long as high; eyes slightly horizontal; postorbital production equalling one-half the horizontal diameter of eye, and also equalling the anterior production at antennae. First antennal segment longer than broad; second, twice as long as broad, with mesal finger one-half as long as third segment; latter nearly three times as long as second, broadest near apex; arista white pubescent, inserted at upper apical angle. Frons with two pairs of frontals. Mesonotum with one dorsocentral; scutellum with two approximated apicals, and a sublateral hair a short distance behind the apicals. Fore femora rather stout, with stout flexor spines on basal half; coxae with three to four stout spines; middle and hind femora slender, with flexor setulae. Posterior crossvein perpendicular.

Nerius durus new species

Similar to *N. flavifrons* but darker; metapleural callus black; the gray mesonotal vittae narrow and distinctly diverging posteriorly; fore coxae without spinules, and the tip of second vein and along the costa before and including tip of third vein infuscated; leaving immediately beyond the tip of second vein hyaline. All femora with three dark rings, leaving the bases and apices yellow; all tibiae with distomedial band and apices infuscated; base of ovipositor black.

Type.—Female; Higuito, San Mateo, Costa Rico, (Pablo Schild), [U. S. N. M., No. 29457].

This species suggests some of the Telostylini, but the lunular calli are polished.

[2] Proc. U. S. Nat. Mus., xxi, 336, 1898.

Nerius dispar new species

Similar to *N. flavifrons*, but the legs, excepting the pale fore coxae, are black. On account of the greasy thorax, I cannot discern any mesonotal striping, nor can I determine the color of the halteres. The pleura is probably black with notopleural and coxal areas pale. Length, 8 mm.

Type.—Female; Porto Bello, Panama, March 13, 1911, (A. Busck), [U. S. N. M., No. 27055].

Micropeza recta new species

Black; frons to nearly surrounding ocellar tubercle in male, humeri, collar and halteres, rufous; face, oral region of occiput, coxae, and femora, yellow; genital segments rufous to yellow; abdominal incisures and venter, whitish; apices and distomedial ring of fore femora, subapical flexor spot and distomedial ring of middle and hind femora, brown; tibiae apically, and tarsi, black; ovipositor segments, shining black. Shining; upper surfaces more or less gray, pleura more so.

Head of male nearly twice as long as high; of female, not so long. Third costal section about two-thirds as long as ultimate section of fourth vein; first posterior cell open. Claspers of male simple, filiform, broadly separated basally.

Type.—Male; Porto Bello, Panama, March 9, 1911, (E. A. Schwarz), [U. S. N. M., No. 27060]. *Paratype.*—One female in copulation on same mount with type.

Micropeza subrecta new species

Very similar to *recta*, and I would not consider the distinction were it not for the different form of the claspers of the male. The apical infuscation, especially of the middle and hind femora is limited to a subapical flexor spot; the fingers of the claspers appear to be fused together basally, while the apical, divergent, filiform, appendages are widely separated.

Type.—Male; Higuito, San Mateo, Costa Rica, (Pablo Schild), [U. S. N. M., No. 27262]. *Paratypes.*—Two males, two females; topotypical.

Micropeza biannulata new species

This species appears to be very similar to *bilineata* v. d. Wulp, but the original description of that species calls for "femora with apex and two rings before it . . . black," which does not apply here.

Frons rufous to yellow; orbits narrowly white anteriorly; vertex brown, cinereous; occiput laterally brown with yellow line above and at oral margin, which latter line continues onto the face; mouth parts yellow; antennae tawny. Thorax dark, densely cinereous, with two brown mesonotal lines anteriorly, attaining suture; humeri and prothorax paler. Abdomen dark, apical margins of segments paler as are also the genital segments and the claspers. Coxae and femora pale, with apex and distomedial ring of middle and hind femora dark; fore femora with broad dark medial ring; tibiae and tarsi black. First posterior cell closed and petiolate.

Head twice as long as high; eyes slightly horizontally elongate. Ocelli and frontal bristles in line with posterior orbits. Claspers as in *turcana*, but fingers not bent forward. Ovipositor pale with dark apex. Length, 7 to 8 mm.

Type.—Male; Higuito, San Mateo, Costa Rica, (Pablo Schild) [U. S. N. M., No. 27263]. *Paratypes.*—Three males, one female; topotypical.

Micropeza distenta new species

General appearance of *appendiculata* but head shorter. Yellow to tawny; frons entirely ferrugineous, opaque or slightly shining anteriorly; vertex surrounding ocellar region dark and cinereous; arista black. Thorax opaque, dark, cinereous, with irregular areas and three narrow, medial stripes, brownish; pleura uniformally whitish but somewhat tesselated when seen from above. Abdomen opaque, dark, with narrow apical margins of segments pale. All femora with distomedial, subapical rings, and apices of tibiae and all tarsi, dark.

Head one and one-half as long as high; eyes round; ocellars and frontal bristles alligned with posterior orbits. First posterior cell closed and distinctly petiolate. Length, 5.5 mm.

Type.—Male; Taboga, Panama, February 2, 1912, (A. Busck), [U. S. N. M., No. 28073]. *Paratypes.*—Four males, one female; topotypical.

Micropeza abbreviata new species

The white shining pleural stripes and the yellow banded ovipositor are the characteristics most prominent in this species.

Black; frons anteriorly, face, collar, alar angles of mesopleura, halteres, posterior margin of abdominal segments, and genital segments, yellowish-white. Legs yellow except apical half of fore femora; medial and subapical rings on middle and hind femora, all tibiae and tarsi, brown to black. Antennae tawny with bare, white, arista. Subopaque to opaque with frons, oc-

ciput above, anterior part of mesonotum, more shining; posterior orbits silvery; mesonotum except the shining areas, sparingly cinereous; pleura with a distinct, vertical, white, pruinose stripe above fore coxa, behind which appears a rather shining vertical stripe in contrast with the remainder of the pleura.

Head obliquely oval, nearly round in profile. Third costal section about one-third as long as ultimate section of fourth vein; first posterior cell open; claspers nearly obsolete, appearing as an arcuate margin of the ventral segment. The female is similar but ovipositor with a conspicuous subapical yellow band. Length, 5 mm.

Type.—Male; Higuito, San Mateo, Costa Rica, (Pablo Schild), [U. S. N. M., No. 29458]. *Paratypes.*—Six males, 12 females; topotypical.

Micropeza sagittifer new species

Similar to *abbreviata.* Face with two median dark spots; the mesopleural mark distinctly arrow-shaped; ovipositor with apex yellow beneath, not noticeably banded; a large subbasal anterior infuscation on hind femora; tibiae yellow except apically; thoracic dusting, brown; pleura with pruinose band not very distinct, so that the shining area behind it is not noticeable. Wings with a diffused cloud between the crossveins, becoming more intense towards the costa; third costal section two-thirds as long as ultimate section of fourth vein.

Type.—Female; Chapada, Brazil, November, (H. H. Smith), [American Museum of Natural History collection]. *Paratype.* —One female; topotypical.

Micropeza tabernilla new species

Black; thorax somewhat rufous along sutures of pleura; coxae also somewhat of the same color; middle and hind femora dark brown with a broad, more or less pale, subapical, band which is more distad on hind femora; hind tibiae brown; mesonotum and abdomen subopaque, brown dusted; otherwise the insect is shining.

Head slightly longer than high, with vertex more swollen than the lower occiput. Abdomen cylindrical; hypopygium very small; no claspers discernable. Hind femora much more robust than the fore and middle ones. Wings very narrow; alula rudimentary; third costal section one-half as long as ultimate section of fourth vein; first posterior cell open. Length, 4 mm.

Type.—Female; Tabernilla, Canal Zone, Panama, July 31, 1907, (A. Busck), [U. S. N., No. 27062].

Micropeza planula new species

The rotund head and closed first posterior cell would place this species in *Cliopeza* Enderlien.

Entirely yellow to tawny or rufous; ocellar spot black; fore femora with apex and subapical ring, (middle legs wanting), hind femora with a medial and a subapical ring, and apex, brown; tibiae and tarsi, black; knob of halteres dark; arista black. Frons except anteriorly, vertex, and posterior orbits, and a line through posterior-verticals and mesad of outer-verticals, rufous. Shining, with sparse brown dust behind ocellar tubercle. Mesonotum and scutellum, rufous as is also the abdomen.

Head almost round in profile, obliquely oval. Third costal section one-third as long as ultimate section of fourth vein; first posterior cell closed at or near costa. Length, 6 mm.

Type.—Female; Cariaquito, Venezuela, January 16, 1911, (S. Brown), [A. N. S. P., No. 6308].

CRYOGONUS new

The species upon which this genus is based has several characteristics, such as the broad wings, presence of dorso-centrals, propleural, and occipital bristles, which will separate it from those of *Micropeza*.

In general build, similar to *Micropeza*. Occiput with a circulet of bristles which range from the outer verticals down under the foramen behind the oral opening up on the other side to the other outer vertical; vertex prominent, more so than the lower occiput; one dorsocentral; a prominent propleural above fore coxa; two sternopleurals. Wings broad and rounded at apex; first posterior cell open.

Genotype.—*Cryogonus reedi* n. sp.

Cryogonus reedi new species

In many respects except in the general characters above mentioned, this species resembles *Micropeza tabernilla* from Panama.

Black; antennae and face tawny; head except vertex, brown, as are also the sutures of thorax and abdomen; halters white. Middle femora with pale subapical ring; hind femora brown with broad subapical band; fore femora with faint subapical pale ring. Shining with upper surfaces more or less subopaque Head one and one-half as long as high. Third costal section two-thirds as long as ultimate section of fourth vein; first posterior cell broadly open. Length, 5 mm.

Type.—Female; Chile, (E. C. Reed), [U. S. N. M., No. 27063].
Paratypes.—Two females; topotypical.

Systellapha cristulata new species

This species runs to *Calobata simplex* Wied. in Enderlein's key, but no decisive characters can be gleaned either from the original nor Enderlein's descriptions, and I do not care to risk a misidentification. It is also similar to *Calobata russula* v. d. Wulp, 1903, except that it has three rings on the middle and hind femora.

Rufous to tawny and generally shining. Mesofrontal beyond ocelli, velvety brown or black; frontalia rufous; parafrontals tawny; no black spot behind ocelli; epistoma black; torma polished black; apices of palpi, and humeri brown; second to fifth abdominal segments brown; ovipositor basally and apically, black. Wings yellowish with faint band between crossveins and a subapical spot, infuscated. Fore femora apically, faint subbasal, distomedial, and subapical, rings on middle and hind femora, brown; fore tibiae black, their tarsi, white. Mesofrontal not much dilated below ocelli, with three strong frontal bristles; a tuft of short bristles above humeri. Length, 7 mm.

Type.—Female; Cordoba, Mexico, April 5, 1908, (F. Knab), [U. S. N. M., No. 27068]. *Paratype*.—One female; topotypical.

Systellapha placidoides new species

Very similar to *Calobata placida* but may be distinguished by the entirely white fore tarsi and base of hind tarsi.

Entirely tawny except abdomen, fore femora above, fore tibiae entirely, and hind tibiae apically, which are darker; fore tarsi entirely and hind tarsi basally, white. Mesofrontal with parallel sides; one frontal bristle discernable; discal infuscation of wings very weak, scarcely discernable except that the veins in that region are bordered. Length, 6 mm.

Type.—Female; Castries, St. Lucia, West Indies, September, 10–22, 1919, (J. C. Bradley, Cornell Univ. Exped.), [Cornell University Collection].

Systellapha baracoa new species

Very similar to *Calobata nebulosa*, in fact the females are difficult to separate except that in the present species the sixth abdominal segment is normal.

Anterior margin of frons, antennae, face, palpi, all coxae and femora, pale yellow; middle and hind femora with faint subapical ring; base of hind tarsi also white. Thorax ferrugineous; sternopleura and metanotum with silvery spot; abdomen nearly black; sixth segment normal. Wings hyaline with dark veins. Three frontals present, the anterior one laterally inclined; superhumeral comb complete and distinct. Length, 5 mm.

Type.—Male; Baracoa, Cuba, September 1901, (A. Busck), [U. S. N. M., No. 27065]. *Paratypes.*—One male, 2 females; topotypical.

Systellapha cantata new species

Very similar to *Calobata placida* but the fore tarsi are entirely white, while in that species the second and third segments are dark. The predominant color seems to be darker particularly of the head, and the torma and palpi are almost black; the frontalia and parafrontals are dark brown. The lateral margins of the mesofrontal are depressed, thus giving a relief appearance to the frons. The cloud in the disc of the wings is scarcely discernable. The coiled condition of the abdomen interfers with the proper examination of the claspers. Otherwise it is very similar to *placida*.

Type.—Male; Boa Vista do Jaquiri, Rio Teffe, Brazil, September 5, 1920, (Cornell Univ. Exped.), [Cornell University Collection].

Systellapha footei new species

Yellow to tawny; ocellar tubercle, margin of torma, abdominal markings, genital segments, fourth and fifth segments of middle tarsi, black; third antennal segment, anterior part of frons, first to third segments of fore, and first of middle, tarsi, pale yellow; face whitish; fore femora except yellow subapical spot above, apices of all femora, all tibiae and humero-notopleural stripe, brown. Wings yellowish with first posterior cell entirely infuscated, darker along third vein; mesofrontal opaque, lateral margins parallel or slightly convex anteriorly; two frontals present; arista sparsely pubescent or subplumose; superhumeral comb of few setulae; sternopleural comb pale. Fifth segment of fore tarsi of male very much dilated, three times as broad as third, that of female less so; also same segment of middle and hind tarsi somewhat dilated. Third costal section three-fourths as long as ultimate section of fourth vein. Length, 8 mm.

Type.—Male; Dominica, June to July, (H. W. Foote; Yale Expedition, 1912), [U. S. N. M., No. 27064]. *Paratypes.*—One male, 2 females; topotypical.

Systellapha flavicaudata new species

Yellow to tawny; abdomen except at base and apex laterally, and bristles, black; sternopleural comb, comb of first abdominal segment, and ovipositor, yellow. Arista black, plumose. Subapical anterior spot of fore femora, and their tibiae, dark; middle and hind tibiae dark apically; all fore tarsi and base of hind tarsi,

white. Wings hyaline with first posterior cell entirely, and somewhat of discal cell, infuscated; third, fourth and fifth veins dark. Third antennal segment scarcely longer than broad; thorax robust, scarcely longer than high; supra-humeral comb of one bristle. Length, 7 mm.

Type.—Female; Montserrat, West Indies, [U. S. N. M., No. 27066].

Systellapha spinuliger new species

Entirely yellow to tawny, with ocellar tubercle, base and apex of fore tibiae, base of fore tarsi, middle and hind tibiae, and genital segments, darker; apex of first and remaining segments of fore tarsi, white. Wings clear. Shining; facial and buccal orbits silvery; opaque mesofrontal scarcely dilated beyond ocellar bristles; palpi slightly broadened; torma very short. Claspers with fingers longer than their basal portion, their mesal edges concaved with short black subbasal, subapical and apical spines. A very slender species with very narrow wings.

Type.—Male; Dominica, June to July, (H. W. Foote; Yale Exped., 1913), [U. S. N. M., No. 27069].

Systellapha pulchrifrons new species

This species probably belongs to the typical *ornatithorax*-group and is apparently similar to *ecuadorensis* Endl., but has only two brown rings on the middle femora and these are sometimes very faint or wanting.

Yellow to tawny, mostly shining. Mesofrontal just before posterior verticals, and large apical, more or less convex, velvety spot, black; frontalia polished black and parafrontals near the large mesofrontal spot, brown; anterior margin of parafrontals pale yellow. Torma polished black; apex of palpi, black; second antennal segment, dark above. Second to fifth abdominal segments, black. Fore tibiae black; fore tarsi white; apical third of fore femora above, more or less faint apical and subapical oblique rings on middle and hind femora, brown. Wings with a triangular infuscated discal spot between the crossveins; apex faintly infuscated if at all. Mesofrontal very broad and somewhat convex anteriorly, but much narrowed at the lunule. Claspers of male with the fingers not longer than their basal portion. Length, 6 to 8 mm.

Type.—Male; Trinidad Rio, Panama, March 18, 1912, (A. Busck), [U. S. N. M., No. 27067]. *Paratypes.*—One male, 18 females; topotypical.

Systellapha panamaensis new species

This species is so similar to Enderlein's description of *columbiana* that I would consider such determination were it not for the described pubescent arista of that species. The arista of the present species is distinctly plumose with long hairs.

Tawny to ferrugineous, with brown or black as follows: opaque mesofrontal spot, frontalia, torma, apices of palpi and proboscis, abdomen except base of ovipositor, apex of fore femora, fore tibiae, subbasal, distomedial and subapical rings on middle and hind femora. Fore tarsi entirely white. Mesofrontal very narrow behind ocelli, dilated before reaching anterior margin. Few bristles above humeri. Discal infuscated spot of wings very distinct, that of apex more diluted. Third costal section as long as ultimate section of fourth vein.

Type.—Female; Alhajuela, Panama, April 7, 1911, (A. Busck), [U. S. N. M., No. 27071]. *Paratype.*—One female; topotypical.

Rainieria alternata new species

In this species the fore and hind tarsi are white, while those of the middle legs are brown. Similar to *Tanipoda seccata* Enderlein, except in the above characteristics and in the shape of the velvety brown mesofrontal.

Black; fore tarsi entirely, and hind tarsi except two apical segments, white; frons dark brown with mesofrontal distinctly blackish brown, narrow; face white pruinose; occiput and frontalia metallic; torma brown. Thorax subopaque to opaque; mesonotum with faint transverse brown band over humeri and a more distinct one between wings, otherwise grayish; pleura more shining and metallic, sparingly cinereous. Abdomen metallic blue with second to fourth segments somewhat brown. Wings hyaline, faintly infuscated apically and subbasally and with distinct medial band; third costal section as long as ultimate section of fourth vein.

Structurally typical, but more robust than *Calobata antennaepes*, with palpi very broad and fingers of male claspers very much curved and with strong basal tooth.

Type.—Male; Porto Bello, Panama, February 23, (A. Busck), [U. S. N. M., No. 27072].

I am using *Rainieria* Rondani (1843) in place of *Tanipoda* Rondani (1856) as I see no reason why the prior name is not tenable. *Tanypoda* Schiner (1864) is merely an amendation. As none of these names have been much in use prior to Enderlein's revision (1922), there is little cause for confusion. *Calobata calceata* Fallen (1820) is the genotype.

Rainieria gilvimana new species

Very similar in structure to *Calobata antennaepes* but not so slender, with very small torma, and is the only species I know in this genus with pale thorax. It is not however a member of *Systellapha*.

Tawny to ferrugineous; ocellar spot, and apical angles of second abdominal segment, black; fore femora medially, medial and distomedial rings on middle and hind femora, brown; all tibiae and tarsi, yellow. Wings yellowish with discal and apical clouds. Shining; mesofrontal scarcely differentiated. Fingers of claspers with a subbasal mesal tooth, the mesally concaved surface otherwise furnished with minute spinules. Frons narrowed anteriorly; palpi cylindrical. Third costal section nearly as long as ultimate section of fourth vein. Length, 6 to 7 mm.

Type.—Male; Alajuela, Panama, March 12, 1912, (A. Busck). [U. S. N. M., No. 27073]. *Paratypes*.—Four males, 3 females; topotypical.

Mimegralla thaiensis new species

This species is probably similar to *Calobata flavicoxa* Endl. and *C. sinensis* Endl. but is evidently quite distinct.

Black; anterior part of frons and face, brown; antennae brown with second segment paler; palpi brown; halteres pale brown. Legs yellow; apical half of fore femora and all fore tibiae, black; fore tarsi white; middle and hind coxae, subbasal, oblique distomedial, and oblique subapical, rings of middle and hind femora, and base of their tibiae, brown; their tarsi yellow much obscured by the black setulae. Mesofrontal velvety black to opposite ocelli, with a cinereous area surrounding the latter. Mesonotum subopaque with reflecting brown and gray pruinose areas and with a slight longitudinal depression above humeri; pleura shining, metallic blue, cinereous. Abdomen shining, metallic tinged. Claspers of male denticulate on the concaved mesal surfaces of fingers. Length, 8 mm.

Type.—Male; Khow Sai Dow, Trong, Lower Siam, 1000 feet alt., January to February, 1899, (W. L. Abbott), [U. S. N. M., No. 27075]. *Paratypes*.—Three males, 4 females; topotypical.

Mimegralla niveimana new species

I cannot associate this form with any species Enderlein mentions under *Calobata*.

Shining black, aeneous, with sparse dark and light dusting; fore coxae and basal half of fore femora, yellow; all fore tibiae, black; fore tarsi white, slightly darkened beneath; proboscis

yellow; palpi dark. Middle coxae dark; femora yellow with slightly discolored ring beyond middle, a suggestion of a subbasal ring, and apex, dark. Hind coxae dark, femora yellow with a proximo- and a disto-medial ring, dark; the latter, narrow and oblique. Middle and hind tibiae are pale with basal fourth dark; their tarsi dark. Frons anteriorly, second antennal segment, parafacials, and halteres, ferrugineous; third antennal segment dark. Mesofrontal, convex; velvety black spot, round, attenuated behind ocelli to twice width of ocellar tubercle. No posterior verticals; arista micro-pubescent; mesonotum without noticeable anterior hump. Wings with faint discal and apical clouds; third costal section nearly as long as ultimate section of fourth. Length, 10 mm.

Type.—Male; Khow, Sai Dow, Trong, Lower Siam, 1000 feet alt., January to February, 1899, (W. L. Abbot), [U. S. N. M., No 27076].

Scipopus frit new species

Very similar to *Calobata belzebul* Schiner, as known to me, differing in that the antennae are paler, more uniform in color with that of the mesofrontal and face; mesonotum more grayish, particularly a broad median stripe anterior to the suture, separated from the humeral gray stripe by an opaque black, posteriorly dilated stripe, not attaining the suture; sternopleura white pruinose with a brown spot near upper margin and a similar stripe across the pectus about midway between fore and middle coxae; hind tibiae brown with the extensor ridge blackish; claspers of male more prominent with basal portion about as long as the fingers; the basal prong of latter nearly one-half as long as the fingers. Length, 10 mm.

Type.—Male; Sangrelaya, Republic of Honduras, April 13, 1924, [A. N. S. P., No. 6309]. *Paratypes.*—Three males, 2 females; topotypical; 1 male, 3 females; Corocito, Rep. Honduras, April 3, 1924, [A. N. S. P. & Bequaert].

Scipopus cartaboensis new species

Very similar to *erythrocephala* but the frontalia is shining, mesonotum with aeneous anterior median stripe, and base of hind tarsi pale with white pubescence. Known only from the female. *Scipopus rufilabris* Endl., appears to be similar, from description, but that species was described from Mexico, and I do not think it is conspecific.

Black with head, including antennae, torma and palpi, yellow to orange; base of hind tarsi pale with white pubescence, that of fore and middle tarsi entirely black. Frontalia shining; meso-

notum subopaque, whitish to aeneous, with a black, more opaque, sublateral anterior stripe above each humerus; sternopleura white pruinose with a brown spot near upper margin; third costal section nearly twice as long as posterior cross-vein. Length, 11 mm.

Type.—Female; Kartabo, Bartica District, British Guiana, March 17, 1922, [New York Zoological Society Collection]. *Paratype.*—One female; toptypical.

Scipopus melaneuris new species

Similar to *erythrocephala* but more slender with wing-veins noticeably infuscated. Thorax elongate, resembling species of *Meganeria.*

Black; head including antennae, torma and palpi, yellow to orange; Mesonotum subopaque with grayish median stripe continuing onto scutellum; pleura entirely white pruinose. Wings brown with all veins broadly infuscated. Frons narrow, one-fourth width of head. Length 9 mm.

Type.—Female; Dominica, June to July, (H. W. Foote; Yale Expedition), [U. S. N. M., No. 27074].

MEGANERIA new genus

The species of this genus have the general habitus of those of *Scipopus.* They are, however, more elongate with the thorax attenuated anteriorly as in *Rainieria;* antennae widely separated by a flat, dorsoventrally convex, shining, setulose, mesofacial production.

Genotype.—*Meganeria geometroides* Cresson, (*Calobata varipes* Johnson, 1895).

Meganeria geometroides new name

1895. *Calobata varipes* Johnson, Proc. Acad. Nat. Sci. Phila., 1895, p. 306 (not Walker, 1853).

? 1830. *Neria geometra* Desvoidy, Myod., p. 736.

It is unfortunate that Johnson's name is preoccupied. *Neria geometra* was described from Carolina, and Osten Sacken suggests that Desvoidy's other species, *Neria atripes, carolinensis,* and *longipes* (Fab.) all described from Carolina may be conspecific with *geometra.* The original description of the latter as "tibias et tarse noirs" is not applicable to Johnson's species. The species is possibly very variable, and specimens fitting Desvoidy's description may occur.

Meganeria daeckei new species

This species is generally found in collections under *Calobata geometra* Desvoidy. It does not, however, agree with the description of that species in the color of the legs: "un anneau noir vers le tiers inferieur des cuisses; tibias et tarsus noirs." The The species is very similar to *varipes* Johnson, except that the apical half of the femora are entirely brown without pale ring. I cannot think that the two are conspecific. Whether this or *varipes* or neither of them is *geometra* of Desvoidy is a question that will have to await the study of more material.

Type.—Male; Elerlys Mill, Pennsylvania, July 12, 1909, (E. Daecke), [A. N. S. P., No. 6289]. *Paratypes.*—Two males; topotypical.

HOPLOCHEILOMA new genus

This genus is proposed for those Taeniapterinae having the postverticals absent, and the torma with a pair or more of short bristles at or near the anterior margin. Frontal areas not very well defined, all rather subopaque. Thorax somewhat higher than long. Third costal section long, and anal cell short.

Genotype: *Hoplocheiloma fasciata* Cresson, (*Musca fasciata* Fabricius, 1775).

Hoplocheiloma notitipennis new species

A black species with reddish head and conspicuous, sharply defined black zigzag bands on the wings.

Black, shining and metallic tinged; head ferrugineous without frontal spot; humeri brown; mesonotum subopaque, mottled with steel blue and brown and with two fine median anterior steel blue lines. Middle and hind femora with narrow, basal and subapical pale rings; first and second segments of fore tarsi and basal three-fourths of first hind tarsal segment, white. Wings hyaline, with three irregular, sharply defined bands, and apex, fuscous.

Head subspherical; mesofrontal area not defined; postverticals absent; Thorax noticeably narrowed anteriorly with one dorsocentral. Tibiae slender. Claspers of male simple. Third costal section as long as ultimate section of fourth vein; ultimate section of sixth as long as anal crossvein. Length, 8 mm.

Type.—Male; San Francisco Mountains, Santo Domingo, West Indies, September 1905, (A. Busck), [U. S. N. M., No. 27074]. *Paratypes.*—One male; topotypical, one male; topotypical, August 29.

Taeniaptera parens new species

This may be *Grallomyia thienei* Endl., but the description of that species does not mention the dorsocentrals; in which respect this species differs from *annulata* Fab. which has but one pair.

Similar to *Musca lasciva* Fab. but frons narrower, one-fourth width of head, vertex rounded; thorax with two pairs of dorsocentrals; fore tarsi with basal half of first segment darkened; middle and hind femora with a distinctly oblique, pale subapical ring, and middle femora also pale at base; the subapical hyaline band of wings broader and less lunate, first posterior cell open, and posterior crossvein transverse. Length, 8 mm.

Type.—Male; Sengrelaya, Republic of Honduras, April 13, 1924, [A. N. S. P., No. 6310]. *Paratype.*—One female; topotypical.

Taeniaptera volens new species

This species belongs to the *annulata*-group, differing from that species in the absence of the postverticals and in having two pairs of dorsocentrals.

Black; head and humeri ferrugineous; legs black to brown with middle and hind femora obliquely annulate with white before apices, and base of hind ones, pale; fore tarsi except basal half of first segment, white. Head spherical; mesofrontal opaque spot small, round and brownish; postverticals absent.

Mesonotum subopaque, greenish-blue, shagreened, unicolorous, with two pairs of dorsocentrals; pleura polished, metallic tinged and white pruinose, with a dark stripe below base of wings. Hind femora distinctly bowed; all tibiae slender and sulcate. Claspers with very small basal prong, scarcely longer than broad. Wings as in *lasciva*, but subapical hyaline band broader and less arcuate; posterior crossvein transverse; situated in a subhyaline spot; the apical cloud is somewhat dissolved, leaving a subapical fascia of fuscous spots. Length, 8 mm.

Type.—Female; Porto Bello, Panama, March 13, 1911, (A. Busck), [U. S. N. M., No. 27078]. *Paratypes.*—Five females; topotypical.

Taeniaptera vulpes new species

This species has the closed first posterior cell of *lasciva*, but the posterior crossvein is transverse and is situated in a subhyaline spot; fore tarsi white except extreme base of first segment.

Black; head yellow to ferrugineous; no black mesofrontal spot; bases and subapical rings on middle and hind femora and bases

of their tarsi, yellow or whitish; fore tarsi except extreme base, white. Wings with three fuscous areas of which the discal one is large and includes the posterior crossvein which is in a subhyaline spot. All polished areas more or less metallic tinged. Mesonotum subopaque, rather grayish, more brownish laterally; pleura with suggestion of white stripe below wings.

Head subspherical ; third antennal segment ovate. Thorax elongate; mesonotum with two dorsocentrals and an oblique series of one or more bristles above humeri. Tibiae slender. Third costal section about three-fourths as long as ultimate section of fourth vein; first posterior cell closed slightly before costa. Male claspers simple. Length, 8 mm.

Type.—Male; Trinidad Rio, Panama, March 18, 1912, (A. Busck), [U. S. N. M., No. 27079]. *Paratypes.*—Seven males, five females; topotypical.

Taeniaptera livida new species

Apparently similar to *Grallomyia albitarsis* Enderlein, but all of fore tarsi, and only the basal segment of the middle and hind tarsi, white.

Entirely black; steel blue, somewhat gray pruinose with shining metallic areas; antennae somewhat ferrugineous. Legs brown to black; fore femora pale apically with suggestion of subapical pale ring; middle and hind femora with oblique, pale subapical ring, also base of hind femora pale; all of fore tarsi, and basal segment of middle and hind tarsi, white. Wings with broad discal cloud including posterior crossvein; narrow subbasal and narrow apical fasciae, fuscus. First posterior cell open. Third costal section nearly as long as ultimate section of fourth vein. Length, 7 mm.

Type.—Male; Trinidad River, Panama, May 9, 1911, (A. Busck). [U. S. N. M., No. 27081]. *Paratypes.*—One male, 5 females; topotypical.

Taeniaptera dilator new species

Similar to *livida* but darker, with brown dusting above humeri at suture, and posteriorly; femora without distinct rings, but apices pale; middle and hind tibiae much dilated, compressed and sulcate; fore tibiae scarcely so; fore tarsi with base of first segment dark; first and second segments of middle, and first segment of hind, tarsi, white. Frons setulose.

Type.—Male; Grenada, West Indies, June 9, (A. Busck), [U. S. N. M. No. 27082].

STUDIES IN THE DERMAPTERA AND ORTHOPTERA OF COLOMBIA

FOURTH PAPER

Orthopterous Family Tettigoniidae

BY MORGAN HEBARD

Study of the katydids of Colombia has further demonstrated the great and varied character of the fauna of that country, commented on by us in our earlier contributions.[1] In those papers we have discussed the sources of the material upon which this series of studies is based and have briefly considered the geographic and zonal divisions of the country. With a final paper on the Gryllidae the series will be completed and we hope there to give a more detailed discussion of the life zones from an Orthopterological standpoint, with lists of the species occurring in each.

We here record three hundred and seventy-three specimens, representing forty-four genera, seventy-seven species and three geographic races, of which seven genera, twenty-five species and one race are new. One entity previously recognized as a species is reduced to racial status, while several generic reassignments are made and a few synonyms are established.

The large number of species of *Anaulacomera* represented is noteworthy, and even in the very last material received from Hermano Apolinar Maria several were included which had not previously been known to us.

The Tettigoniidae are numerically much less abundant than the Acrididae in almost all parts of the world, are usually more secretive and the majority are nocturnal. As a result, when compared with the Acrididae, a far smaller representation of the species present is usually secured by the average collector. Much work, we therefore believe, is still to be done on this family in Colombia.

[1] On the Dermaptera, Blattidae, Mantidae and Phasmidae, Trans. Amer. Ent. Soc., XLV, pp. 89 to 179, (1919); on the same, Trans. Amer. Ent. Soc., XLVII, pp. 107 to 169 (1921), and on the Acrididae, Trans. Amer. Ent. Soc., XLIX, pp. 165 to 313, (1923).

QUIVA new genus

This genus is a member of the Group Aphidniae, nearest *Hammatofera* Brunner. It is erected to include the single species here described, *diaphana*, but the Brazilian *Hammatofera abacata* Brunner may be congeneric, the original description of that species indicating this strongly, but too vague in many important points to warrant a final decision without examination of the type.

Compared with the description of *nodicornis* (Burmesiter), genotype of *Hammatofera*, the present genus is found to differ in the following features. Vertex smooth, not offset from the fastigium which is rounded above and deflexed, terminating in a blunt tooth which is separated by a considerable space from the facial fastigium. Face without lateral carinae. Tegmina very narrow, median vein with two branches and connected with ulnar vein by a short vein. Cephalic tibiae unarmed dorsad except for a single disto-external spine. Caudal femora with genicular lobes bidentate.

The antennae are broken in the unique specimen before us. The first joint is large, the two or three succeeding joints small and simple.

The decurvature of the vertex apparently leaves no room for a nodiform fastigium beneath it and touching the facial fastigium. Though that type of structure is one of the most significant characters for the group, we have no hesitation in placing *Quiva* here, after noting the similarity shown to *Dysonia simplicipes* (Brunner) in the bulging eyes, general contour of pronotum and particularly in the male cerci, which are similarly remarkably hollowed out internally with a lamellate triangular projection meso-proximad on the ventral margin.

Quiva diaphana new species (Pl. XVIII, fig. 1; pl. XX, figs. 1 and 2; pl. XXII, fig. 1.)

Of the known katydids this insect is nearest the species described as *Hammatofera abacata*, by Brunner, from Brazil. From the inadequate description of that insect, *diaphana* is found to differ in being larger, lacking a nodiform process between the apex of the vertex and the facial fastigium, with tegminal maculae apparently more irregular and elongate and wings clear hyaline except for the exposed apical aportions, where the pale spot is not green.

Type.—♂; Aguadita, Cundinamarca, Colombia. May 11, 1914. (From A. Maria.) [Hebard Collection, Type No. 1057.]

The following data is considered of specific value, in addition to that given in the generic description. Size and form much as in *Dysonia simplicipes* (Brunner). Head much as in that genus with large, protruding eyes and face moderately inflated, but interval between antennal sockets extremely narrow. Pronotum subsellate, not constricted, rounding broadly into lateral lobes; the latter with cephalic margin concave opposite the eyes, the ventro-cephalic angles moderately roundly produced, free margin thence evenly convex to below the deep humeral sinus, where the caudal margin is weakly sinuous. Tegmina and wings fully developed, the former elongate and very narrow, showing weakly convex truncation at their narrow extremities. Ultimate tergite truncate dorsad, its free margin weakly concave laterad. Supra-anal plate vertical, hirsute, apparently shield-shaped and bicarinate. Cerci briefly cylindrical proximad where they are directed ventro-caudad and weakly curved, thence seen to be hollow internally, the thin ventral portion produced at end of cephalic third in an internal triangular projection which terminates in a moderately uncinate tooth, this section is horizontal, but distad the cerci curve weakly dorsad with dorso-external margin microscopically serrulate and at the apex projects from each cercus a smaller shaft with claw-like extremity. Subgenital plate produced to base of distal portion of cerci, narrowed, then cleft in two slightly divergent fingers, separated by a deep and narrow V-emargination, each flattened finger surmounted by a small rounded style, no longer than broad. Cephalic and median femora unarmed, their genicular lobes broadly rounded. Caudal femora armed only with a few (3) ventro-external small spines, the genicular lobes minutely bispinose. Cephalic tibiae feebly sulcate dorsad, the apert tympana very large.

Head with face black, a broad sub-ocular band of white encircling it; occiput buffy, the area between the occiput and eyes and two large meso-caudal spots black. Pronotum with ventral portion of lateral lobes white; other portions vinaceous buff tinged with cinnamon, disk with three pairs and a humeral spot and lateral lobes each with two spots of black. Tegmina clear hyaline with blackish brown spots and dots particularly toward the sutural margin, many of which are longitudinal, the intervals tinged with vinaceous buff along that margin. Wings clear hyaline, distal portion of marginal field with confluent blackish brown spots, leaving two large hyaline flecks between which are tinged with vinaceous buff. Pleura white spotted with black. Abdomen shining blackish brown, the tergites margined caudad with white, these pale bands expanding laterad. Sternites

white. Ultimate tergite and cerci black, except medio-external section of the latter which is white. Subgenital plate white except proximo-laterad, the margins of the apices and styles, which are blackish brown. Limbs white (the caudal femora tinged with cinnamon distad), banded and marked with blackish brown externally, suffused with dark brown internally.

Length of body 14.5, length of pronotum 4, caudal width of pronotal disk 3, length of tegmen 26.7, median width of tegmen 3.8, length of caudal femur 18.2 mm.

The type of this very unusual insect is unique.

Dysonia simplicipes (Brunner)

1878. *A[phidnia] simplicipes* Brunner, Monogr. der Phaneropt., p. 157. [♂, Mexico.]

Chocó of western Colombia, 1 ♂, [A. N. S. P.].

This is an intensively marked specimen, the black spots and dots being all heavier than in Costa Rican males before us. With these the present individual agrees closely in structure and coloration, except that the cerci, instead of being white, are black. Due to intensification of the color pattern the adjacent black dots meso-cephalad on the pronotal lateral lobes are fused in a single black spot.

The presence in our unstudied collections of Peruvian material which agrees with the description of *simplicipes*, but upon examination is found to include three species, separable by male cercal differences and less striking features of maculation, shows that the phylum probably breaks into a number of species. Without Mexican material we can not, therefore, determine definitely whether the Costa Rican and Colombian specimens, though agreeing with the description of *simplicipes*, represent the same or a very closely allied species.

Dysonia alipes (Westwood)

1845. *Phaneroptera alipes* Westwood, Arcana Ent., II, p. 87, pl. 70, figs. 1 and 1 a to c. (In part.) [♂, Colombia.]

Pensilvania, Cordillera Central, December, 1912, (from A. Maria), 1 ♂.

Westwood has well figured this, one of the handsomest, species of a most extraordinary genus. The great black foliaceous disto-external lamellae of the caudal femora are much larger and more striking than in any of the related species.

Ceraia hemidactyla (Rehn and Hebard)

1914. *Scudderia hemidactyla* Rehn and Hebard, Trans. Amer. Ent. Soc., XL, p. 291, pl. 9, figs. 11, 15, 16 and 17; pl. 10, fig. 22. [♂, ♀ : Caparo, Trinidad; Paramaribo, Dutch Guiana.]

Susumuco, Cundinamarca, September 15, 1913, (from A. Maria), 1 ♂.

Villavicencio, Intendencia del Meta, 1922, (from A Maria), 1 ♂.

These specimens agree very closely with the type. The species is probably widely distributed over the Orinocan drainage. In addition to the originally described series, a female from Georgetown, British Guiana, is before us, belonging to the Academy.

After careful consideration of the species of the North American *Phaneroptera* Serville (*Scudderia* of most authors) and many South American species of *Ceraia* Brunner, we are convinced that *hemidactyla* must be transferred to the latter genus.

These genera are, we believe, amply distinct. Though, as sometimes occurs, generic diagnostic differences are few and much less satisfactory than is usually the case, a generally different facies combined with these brings about this decision.

The genus *Ceraia* has an appreciably more compact structure, the tegmina are less delicate and the distal curvature of the ovipositor shows appreciable truncation. In the males of most of the species the subgenital plate shows rudimentary styles, in some species such as *hemidactyla* these are reduced to mere vestiges, while in others well developed articulated styles are present. Presence or absence of styles can, therefore, not be used to separate the genera under consideration, as was done by Brunner, unless qualified. In many species the spines of the caudal femora are heavier than in *Phaneroptera*, but in others they are as weak. In *Ceraia* a multitude of species occur, belonging to well defined groups, the male genitalia being strikingly different in these, but in none showing similarity to the types developed in *Phaneroptera*.

Ceraia tibialis Brunner (Pl. XXII, figs. 2, 3 and 4.)

1891. *Ceraia tibialis* Brunner, Addit. Monogr. der Phaneropt., p. 129. [♀; Fonteboa, Amzaonas, Brazil.]

Susumuco, Cundinamarca, September 1913, (from A. Maria), 1 ♂.

A female from Provincia Sara, Bolivia, taken February 5 to 20, 1922, by J. Steinbach, is in the author's collection. These specimens agree fully with the original description, except that the caudal femora ventrad and distad and the caudal tibiae are dark (vandyke) brown, rather than black. Brunner does not mention the head, which in these specimens is liver brown with a large vertical oval spot of warm buff on the cheeks dorsad, between the eyes and antennal sockets.

The previously unknown male has the ultimate tergite roughly triangular, supplied on each side of the rounded apex with a small styliform appendage, straight and directed horizontally caudad, each seeming to have its lateral portions curled upward, thus dorsad deeply and irregularly concave, these appendages extending to the dorsal apices of the subgenital plate. Cerci rather small, stout, tapering and weakly incurved to the rounded apices, which are strongly bent inward and terminated in a short, sharp tooth. Subgenital plate strongly produced, elongate, curved dorsad, tapering proximad to the rather narrow shaft, which gradually expands distad, there produced dorso-laterad on each side in a rounded, almost vertical, lamella, which is longer than wide and directed dorso-caudad; the distal margin between these plates (which probably represent non-articulate, specialized styles) is convex with median portion shallowly emarginate, almost transverse.

The measurements for our pair are; length of body ♂ 22.7, ♀ 32; length of pronotum ♂ 5.8, ♀ 7; length of tegmen ♂ 40.9, ♀ 46.8; width of tegmen ♂ 8.1, ♀ 9.8; length of caudal femur ♂ 29.8, ♀ 35.8; length of ovipositor 12.1 mm.

Of the known species of *Ceraia,* this, the genotype selected by Rehn in 1906, has the spines of the ventral margins of the caudal femora heaviest, those of the internal margins being triangular and the larger suggesting a weak tendency toward *Vellea* Walker.

EUCERAIA new genus

This genus may be distinguished from *Ceraia* Brunner by the rounded lateral margins of the pronotal disk being strongly indented at the principal transverse sulcus, the tegmina with distal margin showing a moderately oblique tendency and median vein (radial ramus) forking before or at the middle, the first of these

forks running into the ulnar vein,[2] the cephalic and median femora with ventro-cephalic margins very finely denticulate and color, which is never rich green and has striking areas of black or brown.[3]

Its affinity to *Ceraia* is shown by the similar form, head and vertex, pronotum with lateral lobes much deeper than wide, general type of male genitalia and apex of ovipositor which, though rounded, shows marked transverse truncation.

Genotype.—Euceraia insignis new species.

We also include in this genus the French Guianan *Ceraia rufovariegata* Chopard. In the genotype the caudal limbs are very short, but in *rufovariegata* they are very elongate.

Euceraia insignis new species (Pl. XIX, figs. 1 to 4.)

This is the most strikingly marked of the known species of the genus; the tympana of the auditory foramina of the cephalic tibiae, margins of the metanotal portion of the pronotal disk and all but the genicular portions of the distal half of the caudal femora being black. The body is individually purplish or yellowish green, this color tinging the diaphanous tegmina proximad, the pronotum and limbs being buffy yellow, the former marked with the body color and black.

In the male the ventral appendages of the bilobate ultimate tergite, which resemble curved cerci (above the only slightly larger, simple, curved cerci) are very distinctive, while in the female the subgenital plate is convex, showing only a trace of median production.

Type.— ♀ ; Pueblo Nuevo de Ocaña, Santander, Colombia. September 3, 1916. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1045.]

In addition to the characters given in the generic description, the following are considered important. Size medium when compared with the species of *Ceraia*, form slightly more robust than is usual in that genus. Vertex declivent with dorsal surface of minute rounded apex of fastigium horizontal, briefly sub-

[2] This feature is also characteristic of *Vellea* Walker, which resulted in its being given for species of *Ceraia* by Brunner, at which time he included *Vellea cruenta* (Burmeister) in that genus.

[3] Brunner's *Ceraia zebrata* alone is conspicuously marked with black, which species may very possibly be representative of a distinct genus.

sulcate only at base of this, briefly separated from facial fastigium. Pronotum with narrow area along cephalic margin of disk and broadly V-shaped area on mesonotum as well as a vertical median area on lateral lobes, impressed. Tegmina and wings fully developed, the former diaphanous, not brightly colored. Caudal femora with both ventral margins finely denticulate, the genicular lobes of these alone very finely bispinose. Ovipositor much as in *Ceraia*, bent dorsad in proximal portion, the margins armed with minute rounded-rectangular teeth only distad, particularly in area of greatest (lateral) curvature. Subgenital plate rather small, its free margin almost evenly convex.

Allotype.—♂; Eden, Nicaragua. May 21, 1922. (W. Huber.) [Acad. Nat. Sci. Phila.]

Size smaller than female. Stridulating area rather elongate, its sutural margin very broadly rounded obtuse-angulate at apex of stridulating vein. Ultimate tergite bilobate distad, beneath which two cerciform appendages project above the cerci and, like them, curve inward, showing, however, greater curvature distad and thus each forming almost a semicircle, their acute apices with margins more heavily chitinous, the inner curling to the apex so that it has an auger-like appearance. Cerci rather simple, curved moderately and evenly inward, tapering and showing horizontal flattening distad; externally at the apex bearing a claw-like, heavy, incurved tooth, the apex of which surpasses and overhangs that of the minute, attingent straight, cylindrical inner portion, the apex of which is rounded. Subgenital plate strongly produced, tapering decidedly proximad, then with produced portion widening very gently to the moderately obtuse-angulate emarginate apex, surmounted on each side by a minute rounded style which is about twice as long as broad; produced portion of plate with lateral margins heavily and roundly carinate ventrad.

General color of head, proximal joints of antennae, impressed portions of pronotum, pleura and abdomen individually dull (mignonette) green or dark vinaceous (dull purplish pink), the same color suffusing the veins of the tegmina proximad. Antennae with other portions buffy, becoming darker distad. Pronotum with ground color apricot yellow, the impressed areas as noted above, those of the disk and the impression laterad of the principal sulcus each with a black dot, the metanotum with lateral margins heavily suffused with black above the humeral sinus, this continued narrowly caudad to the caudal margin and there with a median intervening fleck. In some specimens the cephalic portion of the metanotum has a transverse band of black, due to the fusion of the lateral areas with the median fleck, this band then with a brief median spur invading the

mesonotum. Some specimens, with or without this transverse band, have the tegmina broadly black in portion margining the caudal margin of the pronotum. Tegmina diaphanous faintly tinged with brown, the veins proximad colored as noted above. Limbs ochraceous buff, the auditory tympana of the foramina of the cephalic tibiae tinged with black; cephalic tibiae, apices of other tibiae and all of the tarsi tinged with the body coloration. Caudal femora from apices of swollen proximal portion to near extremities black, the minute buffy spines of the ventral margins thus contrasting sharply.

The Guianan and Brazilian specimens have the pronotum more extensively marked with black, varying individually to different degrees. These more intensively colored specimens also have the occiput blackish before the interocular portion.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Greatest width of tegmen	Length of caudal femur
Eden, Nicaragua. *Allotype*	21.4	5.8	38.8	8.2	23.7
Tumatumari, British Guiana	22	6.1	40	8.8	23.8
Maroni River, French Guiana	22.5	6.3	40.8	9	23.8
♀					
Pueblo Nuevo de Ocaña, Colombia, *Type*	24.8	6.7	47.2	10.3	25.7
Teffe, Amazonas, Brazil.	24.7	6.7	45.5	10	27.1

The ovipositor length in the females is respectively 8.3 and 8.1 mm.

It is surprising to find undescribed, this, one of the handsomest as well as most widely distributed species of the tropical American Tettigoniidae, though we fully realize how much is yet to be learned of that great fauna.

Specimens Examined: 5; 3 males and 2 females.

NICARAGUA: Eden, May 21, 1922, (W. Huber), 1 ♂, *allotype*, [Acad. Nat. Sci. Phila.]

COLOMBIA: Pueblo Nuevo de Ocaña, Santander, September 3, 1916, (M. A. Carriker, Jr.), 1 ♀, *type*.

BRITISH GUIANA: Tumatumari, Rio Pataro, March, 1912, (Wm. Beebe), 1 ♂, *paratype*, [Acad. Nat. Sci. Phila.].

FRENCH GUIANA: Maroni River, (from Wm. Schaus), 1 ♂, *paratype*, [U. S. N. M.].

BRAZIL: Teffe, Amazonas, December 18, 1919, (H. S. Parish), 1 ♀, *paratype*.

Brunner in 1891 placed *Euthyrrhachis*, described by him in 1878, as a synonym of *Plagiopleura* Stål, but it was properly restored to validity by Kirby in 1906. The two genera, which belong to the Group Plagiopleurae, may be separated as follows:

A. Size medium large. Fastigium with depressed apex not advanced as far as that of facial fastigium. Pronotum with disk not conspicuously deplanate between the less sharply rounded lateral carinae, expanding strongly caudad; the lateral lobes with margin concave opposite eyes, thence oblique and very feebly convex to the stronger convexity which forms the ventro-caudal angle. Tegmina with costal margin black for a brief distance proximad, venation less regular; median vein branching proximad, first branch shortly joining ulnar vein and running to sutural margin near apex, second branch running straight to apex. All genicular lobes bispinose, those of the caudal femora strongly so. Cephalic tibiae with dorso-external (and sometimes dorso-internal) margin well spined.

Plagiopleura Stål

[Genotype.—*nigromarginata* Stål.]

AA. Size medium. Fastigium with apex less depressed, which, if continued would curve to meet evenly the apex of the facial fastigium. Pronotum with disk conspicuously depressed between the rather sharply rounded lateral carinae, of equal width or with a mere trace of expansion caudad; the lateral lobes with extensive cephalic margin nearly vertical, very faintly concave to the distinctly defined ventral margin. Tegmina with costal margin flesh-color for some distance proximad, venation very regular; median vein branching distad, sending one or two branches to sutural margin, itself running straight to apex. Genicular lobes of cephalic and median femora blunt, unarmed or with mere vestigial spines, of caudal femora moderately bispinose. Cephalic tibiae entirely unarmed dorsad, or rarely with a single spine mesad on dorso-external margin.

Euthyrrhachis Brunner

[Genotype.—*gracilis* Brunner.]

Euthyrrhachis consobrina (Brunner)

1891. *Plagiopleura consobrina* Brunner, Addit. Monogr. der Phaneropt., p. 133. [♂, ♀; Fonteboa, Amazonas [, Brazil].]

Cundinamarca, (from A. Maria), 1 ♀.

Susumuco, Cundinamarca, October and December, 1919, (from A. Maria), 1 ♂, 1 ♀.

It is of interest to find *consobrina* at the eastern part of the Andes in the Meta (Oronocan) drainage, a species which is now known have an extremely wide distribution in the Amazonian region.

General coloration immaculate, bright courge green. Head with a postocular line of cream color, continued on the pronotum as the well defined lateral carina of the disk, the inner margins there narrowly bordered with acajou red (a deep purplish pink). Costal margins of tegmina to near median portion cream color, the adjacent veinlets very briefly cream color very faintly tinged with purplish.

The tegmina in the present material are proportionately slightly narrower than in the originally desoribed specimens, but this is apparently mainly if not wholly attributable to individual variation.

Length of body ♂ 19.6, ♀ 21.8 and 23.7; length of pronotum ♂ 4.7, ♀ 4.8 and 4.9; caudal width of pronotum ♂ 3.4, ♀ 3.8 and 3.9; length of tegmen ♂ 37.3, ♀ 38.1 and 41; greatest tegminal width ♂ 6.8, ♀ 7.7 and 8.4; length of caudal femur ♂ 23.7, ♀ 23.7 and 25.3; length of ovipositor 5.1 and 5.4 mm.

Parableta integricauda Brunner

1878. *P[arableta] integricauda* Brunner, Monogr. der Phaneropt., p. 254, pl. 5, figs. 78a and b. [♂, ♀; Ecuador and Surinam.]

Cundinamarca, (from A. Maria), 1 ♂, 1 ♀.

The unarmed margins of the Phaneropteroid ovipositor constitute a distinctive generic feature, as does a narrow line of purplish black on the outer surface of the caudal tibiae just below the dorsal margin, which extends to about the apical fourth.

Brunner's full figure is very poor, the insect having more elongate tegmina with broadly rounded apices. It has a Microcentroid, rather than Orophoid or Amblycoryphoid, general appearance.

Group *Steirodontia*

The genera of the Group Steirodontia now recognized, may be separated by the following key.

A1 Second branch of median vein running to apex of tegmina. (Metasternal lobes rounded trigonal.)

B1. Fastigium narrow, but wider than facial fastigium, moderately declivent, sulcate. Pronotal disk smooth, its lateral margins simple or but weakly produced and dentate. Tegmina with sutural margin straight or nearly so from anal field to near apex. Female with distal tergites without ap-

pendages. Femora smooth. Cephalic tibiae with foramina subconchate. Caudal tibiae not expanding proximad. Size medium large for group. 1. *Stilpnochlora* Stål
[Genotype.—*S. marginelle* (Serville)]

BB1. Fastigium wide, but equalling facial fastigium in width, not produced, decurved to a vertical plane, subsulcate. Pronotal disk very finely rugulose, its lateral margins produced in heavily dentate combs. Tegmina with sutural margin showing distinct though broad concavity from anal field to near apex. Female ultimate tergite with two appendages. Femora rough. Cephalic tibiae with foramina rimate. Caudal tibiae expanding strongly proximad. Size very large for group. 2. *Steirodon* Serville
[Genotype.—*S. validum* Stål]

AA1. Branches of median vein running to sutural margin of tegmina.

B2. Pronotum with lateral margins produced in heavily dentate combs. Size medium large to large for group.

C1. Pronotal disk wholly or in part very finely rugulose, its lateral margins moderately to strongly produced dorso-laterad. (Size large for group. Caudal tibiae straight, expanding evenly but decidedly proximad.)

D1. Entire pronotal disk rugulose. Fastigium wide, weakly sulcate, the facial fastigium of equal width. Cephalic margin of pronotal disk very shallowly concave, usually with a median angulate production. (Tegmina with sutural margin showing distinct though broad concavity from anal field to near apex. Cephalic tibiae rimate or conchate.[4] Median tibiae not or decidedly enlarged proximad.[5] Caudal femora unspecialized distad. Ventro-caudal portion of pronotum normal, not produced, evenly rounded.)
3. *Peucestes* Stål
[Genotype.—*P. coronatus* Stål]

DD1. Pronotal disk very finely rugulose in metazonal portion, smooth elsewhere. Fastigium narrower, more strongly sulcate, the facial fastigium much narrower than it. Cephalic margin of pronotal disk evenly concave. (Cephalic tibiae with foramina conchate. Median tibiae decidedly enlarged proximad.) Caudal femora with a short lamellate ridge dorso-distad.

[4] The conchate type is found only in the aberrant *championi*.

[5] The enlarged type is found only in the aberrant *championi*.

E1. Tegmina with sutural margin straight from anal field to near apex. Ventro-caudal portion of pronotal lateral lobes produced, rounded sub-rectangulate. Caudal tibiae expanded rather evenly but decidedly proximad. 4. *Peucestoides* n. gen.
[Genotype.—*P. stridulans* n. sp.]

EE1. Tegmina with sutural margin showing distinct though broad concavity from anal field to near apex. Ventro-caudal portion of pronotal lateral lobes not produced, evenly rounded. Caudal tibiae expanding suddenly and very decidedly proximad.
5. *Cnemidophyllum* Rehn
[Genotype.—*C. lineatum* (Brunner)]

CC1. Pronotal disk smooth, its lateral margins moderately produced dorso-laterad. (Fastigium rather narrow, rather strongly sulcate, the facial fastigium of equal width. Cephalic tibiae with foramina subconchate. Median tibiae not enlarged proximad.)

D2. Cephalic margin of pronotal disk distinctly concave, with a weak median angulation. Ventro-caudal portion of pronotal lateral lobes produced, rounded sub-rectangulate. Tegmina with sutural margin straight from anal field to near apex. Caudal femora with a short lamellate ridge dorso-distad. Caudal tibiae curved, expanding evenly but decidedly proximad.
6. *Eupeucestes* n. gen.
[Genotype.—*E. crassifolius* (Haan)]

DD2. Cephalic margin of pronotal disk concave, with a median angulation or a node. Ventro-caudal portion of pronotal lateral lobes normal, not produced, evenly rounded. Tegmina with sutural margin showing distinct though broad concavity from anal field to near apex. Caudal femora unspecialized distad. Caudal tibiae straight, not or moderately and gradually enlarged proximad.[6] (Cephalic tibiae with opening of foramina linear on cephalic face, apert on caudal face.[7])
7. *Posidippus* Stål
[Genotype.—*P. citrifolius* (L.)]

BB2. Pronotum with lateral margins not produced. Size small for the group. (Cephalic tibiae with opening of foramina sub-linear on cephalic face, apert on caudal face.)

[6] The enlarged type is found only in *validus*.
[7] In *validus* not as fully apert as in the other species.

C2. Fastigium and apex of facial fastigium equally produced and of equal width. Tegmina with sutural margin straight or nearly so from anal field to near apex.
8. *Frontinus* Stål
[Genotype.—*F. degeerii* Stål]

CC2. Fastigium half as wide as and surpassed by apex of facial fastigium. Tegmina with sutural margin showing distinct though broad concavity from anal field to near apex. 9. *Steirodontopsis* Scudder
[Genotype.—*S. bilobata* Scudder]

Stilpnochlora quadrata (Scudder)

1869. *Steirodon quadratum* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 331. [♂; Guayaquil, Ecuador.]

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, November, 1917, (M. A. Carriker, Jr.), 2 ♂, 1 ♀.
Medellin, Antioquia, September, 1912, (from A. Maria), 1 ♂.
Yerico, Antioquia, 1925, (from A. Maria), 1 ♂.
Honda, Tolima, May, 1913, (from A. Maria), 1 ♀.
Muzo, Boyacá, 1922, (from A. Maria), 1 ♀.

The Magdalena males have the stridulating area and stridulating vein unusually wide for *quadrata*, this being clearly a variation toward the type developed in the Jamaican *S. laurifolia* (Linnaeus). That insect, however, has this area considerably wider, while the pronotum narrows much more strongly cephalad. It would appear probable that racial differentiation is taking place in *quadrata* on the northern coast of South America, but that such is not sufficiently advanced to warrant nominal recognition.

Rehn has recorded this species from Cauca, Medellin and Jiminez, Colombia.[8]

Stilpnochlora corrugata new species (Pl. XIX, figs. 5 and 6.)

This, the smallest known species of the genus, is very closely related to the Peruvian *S. incisa* Brunner. It differs only in the much smaller size, pronotum with lateral margins less elevated but transverse sulcations more decided, tegmina with surface appearing like ground glass and corrugated by the more outstanding veinlets and with sutural margin not oblique and straight distad but curving weakly to the apex.

[8] Ent. News, XXVIII, p. 112 and pl. 10, figs. 3 and 6, (1917).

Type.—♂; Cundinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1056.]

Size small for this genus of large species, form normal. Fastigium sulcate proximad, distad curving to meet the facial fastigium, which is slightly narrower. Pronotum with prozona showing two broad transverse sulcations laterad, the lateral margins raised between these, the first two elevations each forming a large, bluntly rounded tooth, the last crenulate and continued on the metazona, there bluntly denticulate to a still heavier though broad transverse sulcation. Tegmina elongate, the sutural margin curving to the rounded apex, surface like ground glass, the heavier veinlets raised and the whole surface corrugated rather than generally smooth as in *incisa;* stridulating field large but not proportionately as broad as in *incisa*, sutural margin at apex of the broad stridulating vein rounded obtuse-angulate; median vein branching near its base, its caudal fork running to the tegminal apex. Ultimate tergite truncate. Cerci small, tapering, cylindrical, almost straight to the incurved apices, which are concave dorsad and at extremity of inner margin are armed with a short, stout tooth. Subgenital plate with apex truncate; styles short, simple. Cephalic and median femora unarmed or with a minute spine distad on ventro-cephalic margins, caudal femora with ventral margins armed with numerous small spines. Genicular lobes bispinose, those of the caudal femora strongly so.

Allotype.— ♀; same data as type. [Hebard Collection.]

Agrees closely with male, differing as follows. Size larger, form more robust. Ovipositor very small, recurved, margins unarmed, slender apices of ventral valves not joining the much broader apices of the dorsal valves. Subgenital plate small, narrowly triangular, medio-longitudinally sulcate proximad, apex broadly rounded.

General coloration deep chrysolite green, apparently faded to mignonette green in the type and allotype. Vertex, face and jaws, but not genae, whitish, the vertex with ventral portion of apex suffused with brown. Lateral and caudal margins of metazona black, this narrow on caudal margin and briefly invading the sulcus on the lateral margins.

The measurements of the allotype are followed by those of a paratypic female bearing the same data. Length of body ♂ 27, ♀ 28.3 and 33 (abdomen distended); length of pronotum ♂ 7.8, ♀ 8.1 and 8.7; greatest (meso-caudal) width of pronotal disk ♂ 6, ♀ 7.2 and 7.3; length of tegmen ♂ 50, ♀ 53.3 and 55.2; greatest tegminal width ♂ 15.7, ♀ 17.8 and 18.3; length of stridulating vein 5.6; length of caudal femur ♂ 26.3, ♀ 27.7 and 28; length of ovipositor 6.8 mm.

This is the northern development of the phylum, probably distributed over the eastern foothills of the Andes in the Meta drainage. Jujuy, Argentina, is the southernmost known point for the related *incisa*.

Peucestes dentatus Stål.

1874. *P[eucestes] dentatus* Stål, Recensio Orth., 2, p. 45. [Panama; Cayenne (= French Guiana).]

Cauca, (F. Bonis), 1 ♂, [Acad. Nat. Sci. Phila.].

This specimen was correctly recorded by Rehn in 1917. We now know its distribution to extend northward to Bocas del Toro, Panama, while Blanchard's record of *"citrifolia"* (not of Linnaeus) from Cayenne, was apparently correctly referred to this species by Stål. Brunner's record of *P. coronatus* Stål from Medellin, Colombia, is probably also referable to *dentatus*. The status of the Mexican *coronatus* is still undecided.

EUPEUCESTES new genus

We erect this genus to include *Locusta* (*Phylloptera*) *crassifolia* Haan[9] and *Peucestes cristatissimus* Brunner. It represents Brunner's section II of *Peucestes*.

Genotype, here selected.—*Eupeucestes crassifolius* (Haan).

This genus agrees closely with *Peucestes* Stål, except as follows. Fastigium and facial fastigium of equal width, narrower than in *Peucestes* and the former with dorsal surface more strongly medio-longitudinally sulcate. Pronotal disk smooth. Cephalic margin of pronotal disk broadly concave, with or without a feeble median tooth. Tegmina with sutural margin straight, showing no broad and weak concavity from anal field to near apex. Metasternal lobes rounded, rather than rounded trigonal. Female with penultimate as well as ultimate tergite having two appendages. Caudal femora with a short medio-longitudinal dorsal lamellate ridge in apical portion. Caudal tibiae moderately curved.

In *Eupeucestes* the pronotum is found to have the specialized lateral combs nearly erect or very strongly flaring. In *Peucestes* a moderately flaring as well as nearly erect type occurs, while a

[9] Karny has definitely assigned *Peucestes striolatus* Brunner to synonymy under this species. Zool. Mededeel. Leiden, v, p. 201, (1920).

very strongly flaring type appears the normal in *Posidippus* Stål and *Cnemidophyllum* Rehn. In this way the two species of *Eupeucestes* bear to those of other genera a closer superficial resemblance than they do to each other.

Eupeucestes crassifolius (Haan)

1842. *L[ocusta] (Phylloptera) crassifolia* Haan, Verh. Natuur. Geschied. Nederl. Overzee. Bezitt., p. 197. [♀, Java (in error).]

Orocué, Intendencia del Meta, May, 1918, (from A. Maria), 2 ♂.

The distribution of this handsome insect is now known to extend from Panama to Chanchamayo, Peru, and Pernambuco and Bahia, Brazil.

PEUCESTOIDES new genus

This genus is erected for the reception of a single new species, *stridulans*. It is very closely related to *Eupeucestes* here described, differing in having the facial fastigium half as wide as the sulcate fastigium; the pronotum with prozonal portion smooth, but metazonal portion very finely granulose and subrugulose and the caudal tibiae straight.

In form of fastigia this insect agrees more closely with *Cnemidophyllum* Rehn, the median tibiae being very strongly expanded proximad as in that insect also, but no more so than in the Central American *Peucestes championi* Saussure and Pictet.

The specialized lateral combs of the pronotum are of the moderately flaring type, showing closest similarity to those developed in *Peucestes dentatus* Stål.

Peucestoides stridulans new species (Pl. XIX, fig. 7; pl. XXII, fig. 15.)

Superficially appearing nearest *Peucestes dentatus* Stål, this insect is easily separated by the features noted above.

The male stridulating field and stridulating vein are unusually broad for the group, this even more decided than in the Jamaican *Stilpnochlora laurifolia* (Linnaeus).

One feature of coloration, the darkening of the specialized lateral portions of the pronotum, is shared only by *Steirodon validum* (Stål) and *Peucestes championi* Saussure and Pictet, among the species belonging to this group before us.

Type.—♂; Orocué, Intendencia del Meta, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1047.]

In addition to the characters given above we note the following. Size medium for the very large species of this group, form robust. Head with fastigium one-third width between eyes, strongly medio-longitudinally sulcate and very strongly declivent, so that it terminates as two rounded fingers between the tips of which the much narrower apex of the facial fastigium is inserted. Pronotum with cephalic margin of disk broadly concave as in *Eupeucestes*, with no trace of a median tooth; lateral margins raised as a dentate comb directed dorso-laterad, much as in *Peucestes dentatus* but with the teeth much blunter, all rounded, thirteen in number as in the males before us of that species,[10] the comb increasing gradually in height to a median point, its lateral outline curved and not showing quite as much production as in *Peucestes dentatus*, less erect and less angulate than in *Eupeucestes crassifolius* (Haan). Tegmina very broad; median vein branching before its median point, the branches running to the sutural margin; structure coriaceous, showing transverse streaks[11] and very minute inconspicuous dots in discoidal field distad. Metasternal lobes produced, rounded. Ultimate tergite with decurved apex very bluntly bilobate. Cerci nearly straight to distal portion, which curves to an erect position, the apex formed by an erect tooth. Subgenital plate small, lateral margins evenly convergent to the transverse, truncate apex, which is divided by a deep acute-angulate median emargination, that space occupying one-third of the apical width. Cephalic and median femora smooth, their ventral margins unarmed except cephalic of the latter which bears (two and three) microscopic teeth, of caudal femora armed with very small spines, genicular lobes bispinose. Cephalic tibiae well enlarged proximad with foramina moderately conchate; median tibiae with enlargement of proximal portion conspicuous, elongate ovate, flattened laterad; caudal tibiae enlarged proximad less conspicuously but more extensively.

General coloration shining lettuce green, the following portions sorghum brown; dorsal surface of lateral combs of pronotum, apices of cephalic and median femora and apical crest of caudal femora, all but brief median portions of cephalic and median tibiae and apices of caudal tibiae. The transverse tegminal lines are a slightly deeper green, but the microscopic flecks are brown.

[10] In females of *Peucestes dentatus* the average of such teeth in our series is fifteen on each side.

[11] These are less strongly defined than is usual in *Eupeucestes crassifolius*.

Length of body 37, length of pronotum 11.8, greatest width between apices of pronotal combs 10.8, length of tegmen 74.8, greatest tegminal width 24.8, width of tegminal stridulating field 12.7, length of stridulating vein 10, length of caudal femur 35.5, width of swelling of median tibia 2.7 mm.

The type of this handsome species is unique.

Posidippus validus Saussure and Pictet

1898. *Posidippus validus* Saussure and Pictet, Biol. Cent.-Amer., Orth., I, p. 373, pl. 18, figs. 10 and 11. [♀; Chontales, Nicaragua.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July, 1913, (M. A. Carriker, Jr.), 1 ♀.[12]

This specimen agrees very closely with a Panamanian female before us, differing only in the slightly lower lateral combs of the pronotum and slightly shorter tegmina, (length 80, greatest width 27 mm.).

Orophus tessellatus Saussure

1861. *Phylloptera (Orophus) tessellata* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 129. [Mexico.]

Murindo, Chocó, February 16, 1918, (M. A. Carriker, Jr.), 1 ♂.
Muzo, Boyacá, July, September and October, 1915, 1916, 1918 and 1922 (from A. Maria), 7 ♂, 6 ♀.

As in an Ecuadorean series recorded by us, the cephalic tibiae, except in the enlarged proximal portion, are strikingly dark brown. The Muzo males are yellow green in general coloration, with tegminal markings very numerous and conspicuous. The females show little tegminal tessellation, one being green, the others wood brown with a vinaceous tinge.

This is a very common species in Central America and is known from Mexico to Ecuador.

Anaulacomera biloba Brunner

1878. *Anaulacomera biloba* Brunner, Monogr. der Phaneropt., p. 286. [♂, Ecuador.]

This insect forms what may be termed the Biloba Group, distinguished by the large size and broad tegmina, the male with inflated and produced ultimate tergite and subgenital plate which curve to meet at their apices and simple cerci, the female with lateral surfaces of ovipositor very finely nodulose. The major

[12] First recorded by Rehn, Ent. News, XXVIII, p. 118, (1917).

difference lies, however, in the cephalic and median femora, which are weakly sulcate ventrad and the cephalic tibiae which are feebly sulcate dorsad. Such is at variance with the diagnosis of the Group Anaulacomerae as given by Brunner, but, like that author, we do not feel justified in attempting even generic separation. Monographic revision may, however, show such action to be necessary.

Boca Murindo, Choc6, February 9, 1918, (M. A. Carriker, Jr.), 1 ♂.

This male is even larger than the Ecuadorean material before us.[13] The male from that country has inconspicuous flecks of brown scattered over the discoidal field of the tegmina as well as a heavy brown marking to and including the stridulating vein; such markings are present in the Colombian individual, though greatly reduced.

Length of body 21, length of pronotum 5, caudal width of pronotal disk 3.2, length of tegmen 32.6, greatest tegminal width 6.8, length of caudal femur 20.8 mm. Brunner's type is smaller, probably taken at a greater elevation.

Anaulacomera gracilis Brunner

1891. *Anaulacomera gracilis* Brunner, Addit. Monogr. der Phaneropt., p. 145. [♂, ♀; Venezuela.]

Cartagena, Magdalena, July 10, 1920, (Rehn and Hebard; common in high bushes, particularly in area of heavy low brush), 23 ♂, 14 ♀.

Puerto Colombia, Atlantico, July 11 and 12, 1920, (Rehn and Hebard; in bushes of semi-arid vegetation), 5 ♂, 1 ♀.

We also have before us a male from Venezuela, taken in 1924, by H. Pittier, belonging to the U. S. National Museum.

Brunner's description is insufficient and the male cerci are not straight, but are very feebly curved inward. The tegminal measurements in the present series are; length ♂ 23.2 to 25.8, ♀ 24 to 27.8; width ♂ 4.7 to 5.1, ♀ 5.2 to 6 mm. The ovipositor is sometimes of subequal width throughout as originally described, but usually shows a slightly greater width mesodistad than elsewhere. The serrations of the ovipositor are coarser than usual in this genus and its lateral surfaces distad are distinctly though finely granulose. The female subgenital plate is small, triangular, with apex bluntly rounded.

[13] Recorded by the author, Proc. Acad. Nat. Sci. Phila., LXXVI, p. 200, (1924)

Anaulacomera asema new species (Pl. XIX, figs. 8 and 9.)

This small species is related to *A. gracilis* Brunner. The male differs in the decidedly smaller size, broader apex of the fastigium, cerci which show appreciable, though very faint, distal thickening and subgenital plate with styliform projections much more prominent.

The species agrees closely with the description of *A. inermis* Brunner, from Ubaque, Colombia, differing in the lateral lobes of the pronotum not being longer than high, the tegmina with sutural margin not rounded and the male subgenital plate with caudal margin not triangularly emarginate, forming triangular projections laterad.

Type.—♂; Choachi, Cundinamarca, Colombia. December, 1914. (From A. Maria.) [Hebard Collection, Type No. 1049.]

Size small, structure slightly less delicate than is usual in the genus. Fastigium sulcate above, its cephalic face broad, as broad ventrad as the first antennal joint, separated from the facial fastigium by a mere line. Pronotal lateral lobes with length equal to depth. Tegmina with median vein branching well before median point.[14] Ultimate tergite truncate, showing weak convexity laterad and mesad. Supra-anal plate triangularly shield-shaped, deflexed, slightly longer than broad. Cerci simple, elongate, curving inward feebly, slender, showing feeble distal thickening, the apex armed with an exceedingly minute tooth, directed inward. Subgenital plate rectangularly produced, the latero-caudal angles produced straight caudad as non-articulate styliform appendages, nearly three times as long as broad. Limbs short for the genus. Ventral femoral margins unarmed, except the external of the caudal femora, which bears one to three microscopic teeth. Cephalic tibiae with dorsal surface showing a trace of sulcation.

Specimens discolored. General coloration apparently light green, the minute areas between the veinlets on the sutural margin brown, the stridulating field apparently with a few weak suffusions of brown.[15] Minute pink flecks, such as occur in

[14] From the series of *gracilis* here recorded, this feature, apparently of decided importance in many groups of the subfamily, is found to be variable in that species. The majority have the median vein branching at or slightly beyond the median point, a few before that point, one far beyond it and in one the median vein does not branch on one of the tegmina.

[15] Not to be confused with the striking dark suffusion to be found in the stridulating field of *A. nodulosa* Stål and other species.

gracilis and *inermis* are not apparent, but this is probably due to discoloration.

Length of body 13, length of pronotum 3.3, length of tegmen 20.3, width of tegmen 4.2, length of caudal femur 14 mm.

The type is unique.

Anaulacomera gibbera new species (Pl. XIX, figs. 10 to 12).

This little insect is a member of the Latifolia Group, distinguished by the elongate lateral lobes of the pronotum and convex sutural margin of the tegmina. This group, though agreeing in many other respects with the Laticauda Group, differs further in the heavier limb armament. To it also belong Brunner's Colombian species *latifolia* and *inermis*.

Compared with *latifolia*, with which nearest relationship is found, *gibbera* differs in the narrower vertex, much narrower tegmina and less clavate male cerci.

Type.—♂; Cundinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1054.]

Size small, form medium for the genus. Fastigium sulcate above, its cephalic face three-fifths as wide as proximal antennal joint, separated from facial fastigium by a narrow interval. Pronotal lateral lobes decidedly longer than deep, their ventral margin almost straight, very broadly bisinuate, their caudal margin flattened opposite the convex callosity. Tegmina with veins and veinlets decidedly more irregular than is usual, the veinlets heavier and forming more longitudinal intervals; median vein branching beyond median point. Ultimate tergite truncate, its free margin seen to be bisinuate in caudal aspect above the simple, deflexed, triangularly shield-shaped supra-anal plate. Cerci simple, elongate, curving inward strongly, slender, showing scarcely any apical thickening, the rounding apex surmounted by a minute uncinate tooth. Subgenital plate narrowing moderately distad, the lateral portions reflexed with margins convex, distad are two short parallel lateral carinae, the extremities of which are produced as non-articulate, small, rounded, styliform appendages, between which the caudal margin of the plate is transversely truncate. Ventral margins of cephalic and median femora unarmed, of the caudal femora supplied with (1 to 3 internal, 4 to 6 external) large spines. Genicular lobes of cephalic femora bluntly, internal of median femora weakly, external of median femora strongly and those of caudal femora very strongly unispinose. Cephalic tibiae with dorsal surface convex, with no trace of sulcation. Median tibiae armed dorsad with five spines.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male in ambisexual features, differing as follows. Organs of flight less elongate. Ovipositor weakly and evenly curved dorsad to its acute apex, appreciably widest in meso-distal portion; lateral surfaces very faintly irregularly rugulose; margins very weakly serrulate, these becoming low, weak, recumbent serrations on ventral margin distad. Subgenital plate small, triangular, with immediate apex minutely emarginate.

General coloration light green, pronotum and femora well supplied with pink dots, face whitish. Male with all but marginal latero-caudal portions of stridulating field suffused with brown, female with anal field suffused with brown proximad, laterad and distad, both sexes with veinlets along sutural margin brown and intervals between these dark brown.

The measurements of this pair are: length of body ♂ 15, ♀ 16.6; length of pronotum ♂ 4.3, ♀ 4.3; length of tegmen ♂ 25.1, ♀ 23.3; width of tegmen ♂ 5.2, ♀ 5.6; length of caudal femur ♂ 15.6, ♀ 15.2; length of ovipositor 6.9 mm.

Anaulacomera latifolia Brunner

1878. *Anaulacomera latifolia* Brunner Monogr. der Phaneropt., p. 296. [♂, ♀; Bogota, Colombia.]

Fusagasugá, Cundinamarca, 5464 feet, 1923, (from A. Maria), ♀.

The present female differs from the original description only in having the apex of the vertex two-thirds as wide as the first antennal joint.

The margins of the ovipositor are subserrulate to near its base, these serrulations becoming slightly heavier on the ventral margin distad, where they are shallowly serrate and recumbent.

The measurements are; length of body (abdomen swollen) 19.2, length of pronotum 4.8, length of tegmen 24.5, width of tegmen 6.7, length of caudal femur 16.7, length of ovipositor 7.8 mm.

Anaulacomera invisa new species (Pl. XXII, fig. 5.)

This is a small species of the Laticauda Group, showing comparatively simple development of the genitalia. It is smaller than the average in this group, with shorter limbs and tegmina, which give it a closer superficial resemblance to forms of the Gracilis Group.

The pronotal lateral lobes are considerably longer than deep in many of the northwestern South American species of this genus, and a tendency toward that condition is here shown.

Type.—♂; Cundinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1052.]

Size rather small, structure delicate. Fastigium sulcate above, its cephalic face slightly over three-quarters as broad as the proximal antennal joint,[16] separated from facial fastigium by a mere line. Pronotal lateral lobes distinctly longer than deep, the straight portion of the ventral margin more extensive than in the allied species. Tegmina with median vein branching at median point.[17] Ultimate tergite truncate. Supra-anal plate rounded-triangular, deflexed. Cerci simple, elongate, curving inward strongly, slender, showing moderate elongate-oval thickening distad, the apex armed with a small tooth, below which the inner surface shows a feeble area of depression. Subgenital plate gradually narrowing distad, the lateral margins showing very feeble convexity, distad are two short parallel lateral carinae which at their extremities form the outer margins of small rounded disto-lateral lobes, between which the distal margin of the plate is very shallowly obtuse-angulate emarginate. Limbs medium for the genus, rather short for the group. Ventro-cephalic margins only of cephalic and median femora (usually) armed with a very few minute teeth, ventral margins of caudal femora armed with (0 to 2 internal, 4 to 6 external) moderately large teeth; genicular lobes rounded, except those of caudal femora, which are bispinose. Cephalic tibiae with dorsal surface convex, not sulcate.

Allotype.—♀; same data as type. [Hebard Collection.]

Agrees closely with male in ambisexual features. Form slightly more robust, tegmina less elongate. Ovipositor evenly and weakly curved dorsad to its acute apex, slightly widest mesodistad; lateral surfaces smooth; dorsal margin microscopically serrulate in all but proximal portion, ventral margin armed distad with small, low, recumbent serrations. Subgenital plate small, triangular, with immediate apex truncate and subemarginate.

[16] In the allotype and paratype slightly narrower, three-quarters that dimension.

[17] This is variable in the species, the median vein branching from before to well beyond that point. Such difference is found in the tegmina of the allotype.

General coloration light green, femora marked with pink dots which are rather larger than usual. Pronotum immaculate in paratype, showing numerous microscopic dots of brown in type and allotype. Males with stridulating vein and adjacent portion of stridulating field of tegmina suffused with brown, both sexes with veinlets along sutural margin yellowish and the intervals between them brown.

The measurements of the type are followed by those of a paratypic male, bearing the same data. Length of body ♂ 15.2 and 15.3, ♀ 16.5; length of pronotum ♂ 3.8 and 3.8, ♀ 3.8; length of tegmen ♂ 24.2 and 25.2, ♀ 23.7; width of tegmen ♂ 4.8 and 4.8, ♀ 5; length of caudal femur ♂ 15.7 and 15.8, ♀ 16.1; length of ovipositor 7.3 mm.

Anaulacomera phaula new species (Pl. XIX, figs. 13 and 14.)

This insect is a larger species of the Laticauda Group, with rather simple genitalic development.

It is intermediate in size between the Mexican *A. laticauda* Brunner and the Guianan *A. nodulosa* Stål.[11] From both it may be distinguished by the minute styliform but non-atriculate projections of the male subgenital plate. The male cerci are similar to those of *nodulosa*. The tegminal venation is slightly coarser than in either of these species and no nodes are developed in the only specimen known to us, but irregular clustering of the veinlets at homologous points occurs.

Type.—♂; Cundinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1053.]

Size large, form rather slender for the genus. Fastigium sulcate above, its cephalic face almost three-fifths as wide as proximal antennal joint, separated from facial fastigium by a mere line. Pronotal lateral lobes as in *nodulosa*, distinctly longer than deep,[19] their caudal margin very broadly convex.[20]

[18] We find *nodulosa* to be a larger species, of which we have a small Guianan series. It is not the insect recorded as *nodulosa* by Brunner from Paramaribo, Surinam, and Colombia; or that so recorded by Rehn from Igarapé-Assú, Pará, Brazil.

The specimens recorded by Brunner from Colombia as *nodulosa* and *laticauda* almost certainly represent distinct though closely related forms. Without examination of the material it is impossible to place these correctly. From a considerable tropical American series of species of the group now before us, it is evident that there is little likelihood of the distribution of either *nodulosa* or *laticauda* reaching as far as Colombia.

[19] In *laticauda* very slightly longer than deep.

[20] Less convex in *laticauda*.

Tegmina with median vein branching somewhat proximad of the median point (known to be variable in the species of the group). Ultimate tergite distorted (probably truncate, with supra-anal plate rounded trigonal and deflexed). Cerci as in *nodulosa;* simple, very elongate, curving inward strongly, slender, showing weak oval thickening distad, the apex rounded and armed inwardly at the base with a minute tooth, directed nearly at a right-angle to the shaft, with a minute impressed area beneath. Subgenital plate as here described for *A. invisa*, except that distad the lateral carinae are produced in non-articulate styliform, slender, slightly tapering appendages, each slightly over twice as long as its proximal width, straight and directed caudad. Between these the caudal margin of the plate is truncate, showing very feeble angulate production at the apex of a very weak distal medio-longitudinal carina. Ventro-cephalic margins of cephalic and median femora armed with a few moderately large spines, the internal unarmed; genicular lobes rounded. Ventral margins of caudal femora armed with (6 and 9 external, 0 and 1 internal) larger spines; genicular lobes bispinose. Cephalic tibiae with dorsal surface convex, not sulcate.

Coloration as described for *invisa* on page 299, except that many of the very small pronotal dots are pink.

Length of body 16.5, length of pronotum 4.2, length of tegmen 29, width of tegmen 5.8, length of caudal femur 16.8 mm.

This species is very closely related to *A. maranona* (Scudder) as examination of the dried alcoholic type shows, loaned through the courtesy of the Museum of Comparative Zoology. Fresh material from the Maranon River in Peru, including males, is needed to place that species. Many other series at hand of a number of species, all belonging to the Laticauda Group, show that it is very unlikely that the same species will be found in the drainage of the both Maranon and Meta Rivers.

Anaulacomera dentata Brunner

1878. *A[naulacomera] dentata* Brunner, Monogr. der Phaneropt., p. 290. [♂, Colombia.]

Villavicensio, Intendencia del Meta, 1925, (from A. Maria), 1 ♂.

This is a rich green insect, with entire stridulating field of the tegmina blackish brown, though beyond, the small areas between the veinlets along the sutural margin are green as elsewhere. The apex of the fastigium is slightly over half the width of the proximal antennal joint. The cylindrical cerci are armed with a blunt finger mesad on the internal surface. The teeth of the ventral femoral margins are large for this genus.

Length of body (abdomen swollen) 16.8, length of pronotum 3.8, length of tegmen 27, width of tegmen 6.4, length of caudal femur 15.2 mm.

Anaulacomera lanceolata Brunner

1878. *A[naulacomera] lanceolata* Brunner, Monogr. der Phaneropt., p. 289. [♂, ♀; Bogota, [Colombia].]

Cundinamarca, (from A. Maria), 1 ♂, 3 ♀.

La Cumbre, El Valle, 6600 feet, May 20, 1914, (H. S. Parish), 1 ♂, [A. N. S. P.].

In these specimens the apex of the fastigium varies from two-thirds to three-fifths the width of the basal antennal joint. The pronotum, particularly dorsad, is quite thickly supplied with minute pink dots. The measurements given for the male by Brunner are identical in the Cundinmarca specimen, very slightly less in that from El Valle excepting that for the caudal femur.

The female is very graceful, with elongate tegmina and wings. The ovipositor is distinctive in having its margins wholly unarmed, its width subequal to the apical portion, its lateral surfaces smooth, the dorsal valves projecting beyond the ventral with dorsal margin there concave and acute apex slightly reflexed as a result. The subgenital plate of this sex is simple, its free margins convex-convergent to the blunt apex.

Anaulacomera hirsuta new species (Pl. XIX, figs. 15 and 16.)

This species belongs near the Peruvian forms described by Caudell, in which great male cercal specialization is found, *hirsuta* having these organs decidedly more foliaceous than in any previously described species.

Type.—♂; Susumuco, Cundinamarca, Colombia. September, 1913. (From A. Maria.) [Hebard Collection, Type No. 1051.]

Size slightly above medium, form slender for the genus. Fastigium sulcate dorsad, apex slightly over half width of proximal antennal joint, in contact with facial fastigium.[21] Pronotal lateral lobes with depth equal to length, caudal margin broadly and evenly convex and curving evenly and more strongly into the ventral margin. Tegmina with no trace of nodes, median vein branching before its median point. Ultimate tergite truncate, its dorsal surface moderately convex laterad and moderately concave mesad to near the base. Supra-anal plate

[21] Injury has occurred to this specimen. In normal position the fastigium may be separated from the facial fastigium by a brief interval, as in some of the species of apparently nearest relationship.

not visible in this specimen. Cerci heavy, elongate, with a large ventro-internal arm and two more distal and smaller ventral processes, these and the apical portion foliaceous. The large proximal arm is flattened, broadens decidedly mesad and terminates in a finger, it is fully two-thirds as long as the cercus beyond it. The first ventral process lies slightly beyond the median point, it is a small rounded lamellate lobe, which curls inward and has its ventral surface more chitinous. The second ventral process lies at the base of the apical portion of the cercus, it is triangular but produced distad in a finger, which gives to the distal portion of the cercus a somewhat chelate appearance. The cercus itself is grooved ventrad from the base of the proximal arm to the median portion, it there becoming foliaceous, the apical portion forming the dorsal, heavier claw of the chelation, its dorsal margin armed with recurved teeth from the point where narrowing begins to the apex. Subgenital plate poculiform, lateral margins straight to the very slightly produced angles formed with the truncate apex, a strong medio-longitudinal carina present, the plate flattening out latero-caudad so that at those angles it is horizontal. Femora more hirsute than usual; cephalic and median unarmed except for a few minute spines on their ventro-cephalic margins, genicular lobes blunt; caudal armed ventrad with (1 and 1 internal, 3 and 6 external) moderately large spines, genicular lobes with external blunt, internal armed with a single small spine. Cephalic tibiae not sulcate dorsad.

Coloration almost wholly destroyed in type. Apparently very uniform, with only slight darkening in the stridulating field.

Length of body 14, length of pronotum 3.9, length of tegmen 27, width of tegmen 4.8, length of caudal femur 15.3 mm.

Anaulacomera caucana new species (Pl. XX, figs. 3 to 6.)

This interesting insect is nearest *A. biramosa* Brunner, described from Huila (Venezuela ?), differing in its larger size and male with lobes of ultimate tergite deflexed and cerci with meso-proximal arm bidentate distad and the shaft with an elongate spiniform process meso-distad. With *A. apolinari* here described they form a group, which we term the Apolinari Group, distinguished by the vertex which is sulcate dorsad but very narrow distad, the male with strongly produced ultimate tergite and highly specialized, branched cerci.

The coloration of the proximal antennal joints, occiput and disk of pronotum, though not striking, is distinctive in *caucana*.

Type.—♂; Cauca, Colombia. [Hebard Collection, Type No. 1054.]

Size slightly above medium, form slender for the genus. Fastigium sulcate above, apex narrow, slightly over one-third width of proximal antennal joint, almost in contact with frontal costa. Pronotal lateral lobes with depth equal to length, caudal margin very broadly convex, curving more strongly and evenly into the straight ventral margin. Tegmina with no trace of nodes, median vein branching slightly before its median point. Ultimate tergite decidedly produced and decurved, deeply concave except laterad, which convex portions are produced as two sharply acute-angulate, decurved projections, between which the caudal margin of the tergite is broadly and deeply U-emarginate. Supra-anal plate concealed. Cerci stoutly cylindrical, directed ventro-caudad and curved weakly dorsad in proximal third, there with a large internal arm, three-quarters as long as the remaining portion of the cercus, which is first directed horizontally inward, then slightly more dorsad in its distal half; thence the cerci are more slender, cylindrical, with internal surface flattened proximad, directed dorso-caudad to their rounded apices and armed mesad in that portion with a straight process having an aciculate apex, this process directed horizontally inward, with an inclination slightly cephalad of transverse. The heavy arm of the cercus is cylindrical in proximal half, broadening moderately and flattened in distal half where its ventral margin is broadly concave proximad, its apex terminating in an uncinate tooth at the distal extremity of the straight dorsal margin. Subgenital plate missing, quite possibly similar to that of the closely related *apolinari*. Cephalic and median femora unarmed or with a very few minute spines on the ventro-cephalic margins, genicular lobes blunt and rounded; caudal armed ventrad with (5 and 6 internal, 6 and 6 external) moderately large spines, genicular lobes with external blunt but armed with a minute ventral spine, internal bispinose but with spines very small. Cephalic tibiae showing no trace of dorsal sulcation.

General coloration light green. Pronotum and femora without minute dots. Apex of first antennal joint and all of a few succeeding joints, fastigium, median portion of occiput and median portion of pronotal prozona suffused with brown. Stridulating field of tegmina narrowly green laterad, elsewhere suffused with brown, particularly proximad and meso-caudad; areas between veinlets along sutural margin green as elsewhere, not suffused. Produced portion of ultimate tergite and all of cerci light coral red.

Length of body 14.8, length of pronotum 3.8, length of tegmen 29.5, width of tegmen 5.3, length of caudal femur 17.4 mm.

Anaulacomera apolinari[22] new species (Pl. XX, figs. 7 to 10.)

This species is nearest *A. caucana* here described, under which species the Apolinari Group is characterized. From that species *apolinari* may be readily distinguished by the immaculate head and pronotum, male ultimate tergite with produced lobes rounded and cerci reflexed only in distal portion but there more strongly so, proximal arm of cerci much smaller and apical portion of shaft highly specialized, suggesting more nearly the apices found in *A. hirsuta*, described on page 302, though that species belongs to a different group.

Type.—♂; Cudinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1055.]

Size, form, fastigium, pronotal lateral lobes and median vein of tegmina as described for *caucana*, except that the fastigium is separated from the facial fastigium by a very narrow interval and the caudal margin of the pronotal lateral lobes is more nearly vertical, thus causing the subsinuous ventral margin to be more extensive. Ultimate tergite decidedly produced and decurved, deeply concave in produced portion and less widely cephalad to near base, the produced portion terminating in two rounded lateral apices between which the caudal margin is shallowly rounded obtuse-angulate. Supra-anal plate small, linguliform, deflexed, vertical. Cerci cylindrical, straight and horizontal in proximal fifth, there with an irregular internal arm, directed horizontally inward and curved slightly caudad; shaft thence in suceeding two-fifths curved moderately inward but still horizontal, internally deplanate with surface dorsally shagreenous, a large internal spine at apex of this section which is horizontal but shows some slight uncination dorsad, in length equalling the proximal arm; thence the distal two-fifths of the cerci are bent suddenly upward as two lamellate plates with flat faces cephalocaudad, thus these plates overlap, they are widest proximad and gradually taper to their rounded apices, their outer margins (a continuation of the ventral margins, but here outer, due to the twist and overlap) armed with a few (5) small teeth directed distad and apices with fewer (3) minute teeth. Limbs and their armament exactly as described for *caucana*, except that the caudal femora have the ventro-internal margin unarmed, the ventro-external margin supplied with (4) moderately large spines.

[22] Named in honor of our friend, Hermano Apolinar Maria, through whose kind interest a large portion of the material under consideration has been assembled.

General coloration light green. Head and femora entirely immaculate. Pronotum with lateral margins of disk buffy. Stridulating field of tegmina suffused with brown except narrowly laterad, areas between veinlets along sutural margin weakly suffused with brown. Produced portion of ultimate tergite and all but base of cerci shining buff with a strong tawny tinge.

Length of body 15, length of pronotum 3.9, length of tegmen 28.8, width of tegmen 5.1, length of caudal femur 18.3 mm.

The type of this distinctively specialized species is unique.

Viadana foreli (Saussure and Pictet)

1898. *Ctenophlebia foreli* Saussure and Pictet, Biol. Cent.-Amer., Orth., I, p. 348. [♂; Santa Marta, Colombia.]

Santa Marta, Magdalena, (Vauvert), 1 ♀, [Paris Mus.]; October, 1917, (M. A. Carriker Jr.), 1 ♂.

Mamatoco, Magdalena, December, 1917, (M. A. Carriker Jr.), 1 ♀.

The specialization of the male subgenital plate is distinctive, of the supra-anal plate and cerci simple but unusual for the genus, recalling the type found in the species of the Laticauda Group of the genus *Anaulacomera* Stål.

The previously unknown female closely resembles that of *V. zetterstedti* (Stål), differing in the smaller size, more produced subgenital plate and shorter, more arcuate ovipositor.

The females here recorded measure as follows; length of body 15.3 and 18 (distended), length of pronotum 4.1 and 4, length of tegmen 26 and 24.3, greatest (meso-distal) tegminal width 10.8 and 10.5, length of caudal femur — and 15.2, length of ovipositor 9.7 and 9.8 mm.

Viadana boyacae new species (Pl. XX, figs. 11 to 13.)

This interesting species agrees rather closely with the Peruvian *V. rhombifolia* (Brunner), the male before us differing from the description of that sex in the longer and proportionately narrower tegmina, produced ultimate tergite, cerci with apices rounded and scarcely at all thickened and longer caudal femora.

In this insect the tegmina have the sutural margin almost straight, the costal margin broadly rounded obtuse-angulate, this giving them a triangular contour, rather than rhomboidal or ovate as in other groups.

From the unstudied tropical American series before us, it appears probable that this genus, next to *Anaulacomera* Stål,

will be found to include the greatest number of species in that region to which both, as properly restricted, are peculiar.

Type.—♂; Muzo, Boyacá, Colombia. August, 1915. (From A. Maria.) [Hebard Collection, Type No. 1058.]

Size moderately large for the genus. Fastigium sulcate between the lateral ocelli, thence with narrow dorsal surface convex, it and the antennal scrobes internally dorsad somewhat more produced than is usual. Cephalic margin of fastigium oblique and moderately retreating to linear transverse juncture with rounded and retreating facial fastigium. Pronotum with disk very feebly concave, lateral margins parallel, sharply defined; lateral lobes perpendicular, slightly deeper than width below humeral sinus, surface subgranulose. Tegmina elongate, widening strongly and evenly to meso-distal point; marginal field opposite insertion of caudal femora considerably narrower than pronotal length; costal margin straight to meso-distal convexity, thence straight to the rounded apex; discoidal vein sending one branch to the ulnar vein and three to the costal margin, of which the last is forked distad. Ultimate tergite flattened mesad, its free margin there rather strongly convex produced with median portion truncate, the produced portion decurved, the supra-anal plate continued from its truncate median section. Supra-anal plate vertical, lanceolate. Cerci elongate, simple, cylindrical, feebly curved inward and dorsad, tapering proximad, not enlarged distad, the rounded apex with a small blunt meso-dorsal tooth. Subgenital plate large, lateral margins broadly concave convergent to the sub-rectangulate emarginate extremity, the lateral apices thus formed bluntly rounded. Cephalic and median femora unarmed except for a few spines distad on the ventro-cephalic margins, caudal femora unarmed except for (2 and 3) small spines on ventro-external margin. Genicular lobes blunt, those of caudal femora sometimes unispinose. Cephalic tibiae with dorsal surface convex.

General coloration immaculate light green (now light turtle green, probably somewhat yellowed through fading).

Length of body 18.3 (abdomen distended), length of pronotum 4, caudal width of pronotal disk 2.4, length of tegmen 30, greatest tegminal width 11, greatest width of tegminal marginal field 4.7, length of caudal femur 16.3 mm.

Phylloptera dimidiata Brunner

1878. *Ph[ylloptera] dimidiata* Brunner, Monogr. der Phaneropt., p. 314. [♂, Colombia.]

Muzo, Boyacá, September, 1918, (from A. Maria), 1 ♀.
Fusagasugá, Cundinamarca, (from A. Maria), 1 ♀.
Cundinamarca, 1 ♀, [Mus. Comp. Zool.].

So much individual variation is apparent in this species that, though these Colombian specimens differ from any in a Central American series before us, in having the pronotal lateral lobes slightly deeper and narrower with ventro-cephalic angle more sharply rounded, we do not believe that even geographic racial differentiation can be recognized.

The discoidal field of the tegmina is immaculate in two, showing one or two very small median spots in one, of the Colombian individuals. In twelve Central American specimens at hand,[23] three to five median maculae occur in this field, though almost obsolete in one Panamanian example. Such differences are, by the series before us, plainly shown to be due to individual variation.

Phylloptera arata Brunner

1878. *Ph[ylloptera] arata* Brunner, Monogr. der Phaneropt., p. 315. [♀, Peru.]

Susumuco, Cundinamarca, September, 1913, (from A. Maria), 1 ♂.

This individual is almost identical with a male, taken at Chanchamayo, Peru, at 1000 meters, in the Academy Collection.

The species, with tegmina showing eight to ten straight, oblique bands of different texture and heavily armed limbs is easily the most striking and distinctive of the known species of *Phylloptera*. The genitalia of the previously unknown male show no striking features, being of the type usual in the genus.

The measurements of the Peruvian male are given last. Length of body 19.5 and 18.2, length of pronotum 5 and 4.8, depth of pronotal lateral lobe 5.1 and 4.9, width of pronotal lateral lobe 3.7 and 3.6, length of tegmen 36 and 36.2, greatest tegminal width 11.5 and 10.5, length of caudal femur 18.5 and 18 mm.

[23] The species will shortly be more fully discussed in a paper on the Tettigoniidae of Panama.

ITARISSA Walker

1869. *Itarissa* Walker, Cat. Dermapt. Saltat. British Mus., II, p. 390. *Genotype*, by monotypy, *I. laurinifolia* Walker.[24]

1875. *Coelophyllum* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 263. *Genotype*, by monotypy, *C. simplex* Scudder.[25]

1878. *Prosagoga* Brunner, Monogr. der Phaneropt., p. 320, pl. 6, fig. 92. *Genotype*, by monotypy, *P. nitidula* Brunner.[26]

Rehn placed *Prosagoga* as a synonym of *Coelophyllum* in 1917,[27] at which time he revised the species related to *simplex*. We now find not only that Walker's *Itarissa laurinifolia* represents the same genus but also the same group which Rehn revised and which we here recognize as the Laurinifolia Group. The separation of species and association of sexes for this group is a difficult problem, in need of monographic treatment.

Itarissa crenulata (Brunner)

1891. *Prosagoga crenulata* Brunner, Addit. Monogr. der Phaneropt., p. 171. [♂, ♀: Guiana; Pernambuco, [Brazil,] and Upper Amazon.]

Cundinamarca, (from A. Maria), 1 ♂.

This male differs from one recorded from Caparo, Trinidad, by Rehn as *crenulata*, in the slightly narrower head, pronotum with disk widening distinctly less caudad and slightly narrower tegmina. These differences are apparently not sufficiently decided to warrant racial recognition.

In addition to the features given by Rehn to separate the species from his *costaricensis*, we note that the male stridulating field of the tegmina is proportionately decidedly shorter. Both of these species belong to the Laurinifolia Group.

The present male has the tegmina immaculate except for a very narrow marginal suffusion of reddish brown, which color wholly occupies the stridulating field.

Length of body 17, length of pronotum 5.8, caudal width of pronotal disk 3.8, length of tegmen 32.2, greatest tegminal width 11.1, length of caudal femur 13.8 mm.

[24] Based on a female from Pará, Brazil.

[25] Based on a female from the Rio Marañon, Peru.

[26] Based on a male from Surinam.

[27] Ent. News, XXVIII, pp. 152 to 161, pl. 12.

Itarissa costaricensis gracilior new subspecies (Pl. XX, fig. 14.)

The present insect agrees fully with the type before us of the Costa Rican *I. costaricensis* (Rehn),[28] differing only as noted below. These features appear to be too decided for individual variation and we believe that additional Andean material will corroborate the opinion that a geographic race there exists.

Type.—♂; Muzo, Boyacá, Colombia. May, 1919. (From A. Maria.) [Hebard Collection, Type No. 1059.]

Size smaller than in typical *costaricensis*, though large for the genus. Head slightly narrower, but with apex of similarly sulcate fastigium slightly blunter. Pronotum with disk widening weakly caudad, less so than in the typical condition. Tegmina narrower.

This specimen is shining green, the tegmina each with two large areas of pseudo-desiccation of prouts brown, one at the base of the median vein and divided by the ulnar vein, the other at the bifurcation of the median vein. Head with a postocular line and proximal antennal joints marked on the inner side with dark brown. Tibiae very finely dotted with dark brown, particularly on the faces which are usually exposed.

Length of body 21, length of pronotum 6.2, cephalic width of pronotal disk 2.9, caudal width of pronotal disk 4.3, depth of pronotal lateral lobe 5.1, width of pronotal lateral lobe 4.9, length of tegmen 35, width of tegmen 13, meso-proximal width of tegminal marginal field 6, length of caudal femur 15 mm.

The type of *costaricensis costaricensis* shows the following dimensions of particular contrast. Cephalic width of pronotal disk 3, caudal width of pronotal disk 4.8, length of tegmen 39.3, width of tegmen 15.8, meso-proximal width of tegminal marginal field 6.8 mm.

Itarissa subcrenulata new subspecies (Pl. XXI, fig. 1.)

This species is nearest *I. flavo-limbata* (Brunner), the present female differing from an example of that sex from Teffe, Amazonas, Brazil, in the author's collection, in the smaller size, pronotum which is very finely microscopically impresso-punctulate rather than almost smooth, narrower tegmina with marginal field narrowing evenly from meso-proximal portion instead of being about as wide meso-distad as meso-proximad, veins of the discoidal field forming with the veinlets more

[28] Described Ent. News, XXVIII, p. 156, pl. 12, fig. 3, (1917).

regular large areolae and margins of anal field, instead of being smooth, showing a subcrenulate lateral outline when observed directly from above.

These insects agree in the shining rich green coloration, coriaceous tegmina with median vein springing from the discoidal vein beyond the median point of the latter, ulnar and discoidal veins connected by several transverse veinlets before that point and ulnar and median veins also connected by transverse veinlets.

Type.— ♀ ; Villavicencio, Intendencia del Meta, Colombia. 1922. (From A. Maria.) [Hebard Collection, Type No. 1075.]

In addition to the characters given above, the following are considered diagnostic. Size rather small for the genus. Narrow fastigium dorsad with a deep, linear, longitudinal sulcus, its apex well separated from that of the facial fastigium. Face smooth, swollen, flattened laterad and separated from the smooth genae by a moderately decided infra-ocular sulcus. Pronotum evenly and rather thickly supplied with microscopic impressed punctae. Tegmina rather narrow for the genus, sutural margin rounding broadly distad, not truncate, marginal field narrowing strongly but evenly distad. Tegmina with an adventitious vein between the ulnar vein and sutural margin, connected with the former by cross-veinlets which thus form a series of large areolae; heavy discoidal vein of ventral surface almost straight, faintly sinuous. Wings with minute portion of apices projecting but not extending caudad of tegmina. Ovipositor short and broad, its margins serrulate distad, the dorsal straight and oblique in distal portion. Subgenital plate subchitinous mesad, the apex with a small rounded emargination. Cephalic and median femora with ventral margins unarmed except for a few (1 or 2) microscopic spines on the internal of the former; caudal femora with ventral margins supplied with (5 and 6 internal, 8 and 9 external) minute spines. Genicular lobes of cephalic and medial femora rounded, of caudal femora bispinose internally, such subobsolete externally.

General coloration shining yellowish oil green. Eyes dresden brown. Pronotum with lateral carinae of disk buffy. Tegmina with costal margin beyond proximal portion rather decidedly cingulate, this light ochraceous tawny becoming buffy externally.

Length of body, 21.7, length of pronotum 5.8, cephalic width of pronotal disk 3.1, caudal width of pronotal disk 5, length of tegmen 34, greatest (sub-median) tegminal width 12.9, greatest (proximal) width of tegminal marginal field 5.7, width of tegminal marginal field at apex of caudal femur 3.3, length of caudal femur 17, length of ovipositor 5.4 mm.

Hyperphrona nitidipennis (Stål)

1874. *P[lagioptera] nitidipennis* Stål, Recensio Orth., II, p. 34. [♀, Colombia.]

Muzo, Boyacá, 1922, (from A. Maria), 1 ♂.

This male agrees closely with the excellent original description. The tegminal stridulating field is immaculate. The cerci are simple, incurved, tapering, with weakly uncinate apices very faintly thickened.

Length of body 22, length of pronotum 5.2, length of tegmen 37, greatest tegminal width 12.2, length of caudal femur 20.5 mm.

Pycnopalpa bicordata (Serville)

1825. *L[ocusta] bicordata* Serville, Encycl. Méthod., Ins., X, p. 343. [♀, Brazil.]

Cauca, (F. Bonis), 1 ♀, [A. N. S. P.].

This species has been recorded from Bogotá by Brunner. That material was, however, certainly taken in the adjacent tropical lowlands. The species and its synonymy will be treated shortly in a study of the Tettigoniidae of Panama. From series before us we find that the species reaches from the state of Vera Cruz, Mexico, to Rio de Janeiro, Brazil.

Microcentrum philammon Rehn

1918. *Microcentrum philammon* Rehn, Trans. Amer. Ent. Soc., XLIV, p. 357, pl. 19, figs. 7 to 9. [♂; Puntarenas, Costa Rica.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July 10, 1913, (M. A. Carriker Jr.), 1 ♂.

Las Mesitas, Cundinamarca, May, 1918, (from A. Maria), 1 ♀.

Series, shortly to be recorded, are also before us from Panama and Nicaragua.

Syntechna olivaceo-viridis Brunner

1878. *S[yntechna] olivaceo-viridis* Brunner, Monogr. der Phaneropt., p. 348. [♂, ♀; Colombia, Venezuela and Ecuador.]

Muzo, Boyacá, 1922, (from A. Maria), 1 ♂.

Tequendama, Cundinamarca, 1925, (from A. Maria), 1 ♂, 1 ♀.

Susumuco, Cundinamarca, September 15, 1913, (from A. Maria), 1 ♂.

Villavicencio, Intendencia del Meta, December, 1918, (from A. Maria), 1 ♂, 1 ♀.

Not only are the males of this species larger, with tegmina broader distad, than those of *S. tarasca* (Saussure), but those here

recorded are further distinguished by the more olivaceous tinge of the green general coloration, the stridulating area immaculate, lacking any brown proximo-laterad, and the cerci cylindrical at their incurved apices, instead of there being flattened dorsad.

Syntechna tarsaca (Saussure)

1859. *P[hylloptera] tarasca* Saussure, Rev. et Mag. de Zool., (2), XI, p. 203. [Michoacan, Mexico.]

Cauca, (F. Bonis), 1 ♀, [A. N. S. P.].

La Cumbre, El Valle, 6600 feet, May 19 and 20, 1920, (H. S. Parish), 1 ♂, 1 ♀, [A. N. S. P.].

Muzo, Boyacá, September, 1918, (from A. Maria), 1 ♂.

Choachi, Cundinamarca, February, 1917 and September, 1918, (from A. Maria), 5 ♀.

Susumuco, Cundinamarca, May, 1917, (from A. Maria), 1 ♀.

Villavicencio, Intendencia del Meta, December, 1918, (from A. Maria), 1 ♀.

This species is known to range from Mexico to Ecuador.

Philophyllia guttulata Stål)

1873. *P[hilophyllia] guttulata* Stål, Öfv. K. Vetensk.-Akad. Förh., 1873, No. 4, p. 42. [♀, Brazil.[29]]

Orocué, Intendencia del Meta, May, 1918, (from A. Maria), 1 ♀.

This is the first South American record for this large and handsome katydid, which is known northward into Mexico.

PSEUDOPHYLLINAE

Acanthodis curvidens (Stål)

1875. *B[risilis] curvidens* Stål, Bih. K. Svenska Vetensk.-Akad. Handl., III, No. 14, p. 39. [♀; Chiriqui, [Panama].]

Jiminez, El Valle, June, 1907, (M. G. Palmer), 1 ♂, [A. N. S. P.].

This specimen apparently represents the previously unknown male of *curvidens*. Compared with Brazilian males of *A. aquilina* (Linnaeus) it is found to differ in the much smoother pronotum, the more elongate cerci which are straight to their rectangularly incurved apices and styles which are elongate, finger-like, with rounded apices and their ventral surfaces concave and apparently not chitinous.

In *aquilina* the male cerci are shorter and more strongly and generally curved inward, so that the apices are directed cephalad,

[29] In error. Corrected, Mexico, in 1874.

while the styles are represented by distinctive processes, very slender and fang-like, directed dorso-caudad and then curved evenly ventrad.

The measurements of the present male are; length of body 36.8, length of pronotum 9.1, caudal width of pronotal disk 5.8, length of tegmen 52.5, width of tegmen 9, length of caudal femur 28.7, length of cercus 4, length of style 3.8 mm.

Acanthodis longicauda (Stål)

1874. *B[risilis] longicauda* Recensio Orth., II, p. 79. [♀, unknown locality.]

Villavicencio, Intendencia del Meta, 1916, (from A. Maria), 1 ♂.

This male apparently represents *longicauda*, of which species the Academy possesses four Peruvian females. It is distinguished from *A. aquilina* (Linnaeus) by the larger size and pronotum with all its nodes more decided. The cerci are heavy and almost intermediate between those of *aquilina* and *A. curvidens* (Stål). The styles are of the same type as found in the latter species, but decidedly more elongate and slender. The huge ovipositor of the females before us is, in all, longer than the caudal femur.

The male measures; length of body 42, length of pronotum 10.8, caudal width of pronotal disk 6.7, length of tegmen 59, width of tegmen 12, length of caudal femur 32.8, length of cercus 3.8, length of style 3.4 mm.

If this proves, as we believe, to represent the male of *longicauda*, the difference from *aquilina* in cerci and styles offers convincing evidence that a distinct species rather than a race or optimum development (as has been suggested) is represented.

Pristes minor Brunner

1895. *Pristes minor* Brunner, Monogr. der Pseudophyll., p. 136. [♀, Venezuela.]

1915. *Pristes colombiae* Bruner, Ann. Carnegie Mus., IX, p. 348. [♀; [between] Bonda and Don Diego, Magdalena, Colombia.]

This insect is very similar to *P. tuberosus* (Stål) and may prove to be merely a depauperate phase of that species. Such is suggested by the material described as *colombiae* by Bruner, which clearly does not merit nominal recognition, agreeing with *minor* but showing a tendency toward *tuberosus*.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July, 1913, (M. A. Carriker Jr.), 2 ♂, 1 ♀.
Jiminez, El Valle, May, 1907, (M. G. Palmer), 1 ♀.

The size of these specimens is quite uniform, a Cincinnati pair measuring as follows. Length of body ♂ 46, ♀ 43.5; length of pronotum ♂ 11, ♀ 10.9; length of tegmen ♂ 45, ♀ 51; width of tegmen ♂ 11, ♀ 11; length of caudal femur ♂ 31.4, ♀ 32.8; length of ovipositor 29.8 mm.

The sternum is pale or brown in the Cincinnati specimens, darker brown in the Jiminez individual.

Gnathoclita sodalis Brunner

1895. *Gnathoclita sodalis* Brunner, Monogr. der Pseudophyll., p. 179. [♂, unknown locality.]

Cauca, (F. Bonis), 1 ♂, [A. N. S. P.].

This specimen agrees fully, except in color, with the very inadequate original description, but differs from the generic diagnosis in having the internal genicular lobes of all the femora unispinose.

The general coloration is chestnut, except as follows. Cephalic femora for a considerable distance dorso-proximad and all tibiae broadly dorso-mesad, as well as most of the tegminal veins green, the latter yellowish buff proximad in the marginal field and narrowly along the margins. Face, mandibles and pronotum blackish chestnut brown. Genae, most of the prozona, ventral surface of the caudal femora and cerci buffy.

Length of body 26.4, depth of head from occiput to apices of mandibles 10.8, length of pronotum 6, length of tegmen 10.7, median width of tegmen 3.5, length of cephalic femur 7.8, length of caudal femur 13.1 mm.

Group *Cocconoti*

After considerable study of the two large genera which belong to this group, *Bliastes* Stål and *Cocconotus* Stål, we are convinced that a number of generic entities have been included in the former and probably in the latter by Brunner.

The best diagnosis of *Bliastes* is, therefore, that by Stål in 1874.[30] From that genus we believe *Nastonotus* Bolivar is separable, to which genus we further refer *Bliastes lineolatus* Brunner.

[30] Recensio Orth., II, pp. 65 and 91.

The genus *Cocconotus* may also require division, but further studies appear advisable before attempting this. However, we here define the Degeeri Group, including the genotype *degeeri* (Stål) and its allies, to which may eventually be restricted the generic entity *Cocconotus*, adding to the characters given by Stål[31] the following. Male cerci short and heavy, subgenital plate produced, with narrow apex not emarginate but with four projections and styles comparatively short. Penultimate sternite of female simple. Ovipositor moderately wide proximad, but with dorsal margin showing no angulation, dorsal margin feebly serrulate, ventral margin very feebly serrulate distad.

Nastonotus lineolatus (Brunner)

1895. *Bliastes lineolatus* Brunner, Monogr. der Pseudophyll., p. 185. [♀; Santa Marta, Colombia.]

Cartagena, Bolivar, July 10, 1920, (Rehn and Hebard; occasional in low bushes, in arid environment), 3 small juv. ♂, 2 small juv. ♀.

Puerto Colombia, Atlantico, July 11 and 12, 1920, (Rehn and Hebard; in large numbers hiding at bases of Aloe leaves wherever these plants grew, in very arid environment), 1 ♂, 1 ♀, 7 juv. ♂, 7 juv. ♀.

Santa Marta, Magdalena, October, 1917, (M. A. Carriker Jr.), 1 juv. ♂, 1 juv. ♀.

Mamatoco, Magdalena, December, 1917, (M. A. Carriker Jr.), 3 ♂, 4 ♀, 3 juv. ♂, 2 juv. ♀.

The Mamatoco adults average larger, with faces paler, than those from Puerto Colombia. The extremes in this series are: length of body ♂ 39.7 to 45, ♀ 35 to 45; length of pronotum ♂ 6.8 to 7, ♀ 6.2 to 7.8; length of tegmen ♂ 30 to 31.1, ♀ 26.8 to 33.7; length of caudal femur ♂ 18.7 to 19, ♀ 17.8 to 20.5; length of ovipositor 17 to 20 mm.

At Cartagena one mimosa was found, from which a large pear-shaped nest of small yellow-banded wasps hung. Near this nest were three immature individuals of *lineolatus*, resting on the twigs and apparently having sought protection from the proximity of the wasp nest. When approached all tumbled to the ground without jumping. Adults taken out of their place of concealment in the day time were clumsy and slow in their movements.

[31] Recensio Orth., II, pp. 65 and 89, (1874).

Bliastes atrifrons Brunner

1895. *Bliastes atrifrons* Brunner, Monogr. der Pseudophyll., p. 190. [♀; Chiriqui, Panama.]

Andagoya, Antioquia, April 24, 1918, (M. A. Carriker Jr.), 1 ♂.

This specimen agrees in full with the description of the type, except that it is decidedly larger, the median femora have two ventro-external spines and the caudal femora six. Material from Panama may show the present insect to be very closely related but a distinct species.

Length of body 38, length of pronotum 6.8, length of tegmen 33.2, width of tegmen 7, length of caudal femur 22.2 mm.[32]

Bliastes annulipes new species (Pl. XXI, figs. 2 and 3.)

This insect lacks a spine on the internal genicular lobes of the cephalic femora. This would place it in *Cocconotus* Stål, according to Brunner, but as Griffini has pointed out, other features must also be used to separate these genera.

The truncate apex of the male subgenital plate and distal femoral annuli readily distinguish *annulipes* from those previously described.

Type.—♂; Fusagasugá, Cundinamarca, Colombia. 1923. (From A. Maria.) [Hebard Collection, Type No. 1078.]

Size small, form moderately robust but graceful for the genus. Fastigium with swellings above the lateral ocelli elongate; surface medio-longitudinally sulcate to near apex, which does not reach as far as do the antennal scrobes. Face largely smooth, with ventral half of lateral margins bluntly carinate. Proximal joint of antennae only bluntly produced disto-internally. Pronotum with cephalic margin smooth and very weakly convex; surface weakly wrinkled and subtuberculate, with two deep transverse sulci and a medio-longitudinal carina briefly indicated caudad on metazona. Tegmina and wings surpassing caudal femora by a very short distance; the stridulating field of the former of moderate size, large for the genus. Ultimate tergite truncate, showing very broad and weak convexity above the large, broadly shield-shaped, deflexed supra-anal plate, the apex of which is broadly rounded, its dorsal surface with a large meso-distal impressed dot. Cerci simple, heavy and straight in proximal third, there narrower, thence somewhat flattened vertically, deeper than wide, incurved and gently tapering to the very sharply rounded apices and showing a faint decurvature

[32] The cephalic femora are malformed in this specimen.

distad. Subgenital plate weakly produced for the genus, narrowing gradually but slightly more strongly distad, apex truncate between the large style sockets, which are the termini of rounded lateral carinae. Styles simple, cylindrical, elongate, slightly tapering and very feebly recurved. Genicular lobes of the cephalic and median femora unarmed, except the internal of the latter which bear a single small spine;[33] those of the caudal femora armed with a single curved spine, the external very small. Ventro-cephalic margins of femora armed with small spines (of cephalic 2 and 4, of median 1 and 1, of caudal 5). Cephalic tibiae hirsute, dorsal surface deplanate and unarmed, auditory foramina weakly conchate.

General coloration ochraceous tinged with brown. Face shining black, clypeus russet, labrum buffy; fastigia, proximal antennal joints, cephalic portion of occiput and subocular suffused areas blackish brown, the occiput paler caudad, the genae ochraceous tinged with buff. Other portions of antennae tawny, some intersections darkened. Pronotal disk and nearly dorsal half of lateral lobes blackish brown, the former solid, the latter showing russet mesad and with brief lines of buffy partially defining its lateral margins cephalad and caudad; ventral portions of lateral lobes of the pale general coloration, this angularly invading the dark dorsal band at the principal sulcus. Tegminal ground coloration chestnut brown, veins rich cinnamon brown, all veinlets buff, these latter forming clusters in the areolae of the discoidal field, which to the naked eye give the appearance of irregular pale spots. Wings transparent, uniformly and moderately suffused with mummy brown. Limbs ochraceous tinged with brown, the cephalic femora weakly, the median and caudal femora strongly suffused with dark brown distad, in each of which areas is a broad annulus of pale buff. Small femoral spines pale, with russet tips.

Length of body 26.5, length of pronotum 6.7, caudal width of pronotal disk 4, length of tegmen 24.5, width of tegmen 5.3, length of subgenital plate 3.7, length of style 2, length of cephalic femur 9, length of caudal femur 17.8 mm.

CHIBCHELLA new genus

This genus is erected to include the single species, *C. personata* here described. It is a peculiar little insect, in general form and appearance suggesting a diminutive species of *Cocconotus* Stål, but the armament of the femoral genicular lobes and very narrow ovipositor indicate closer affinity to *Bliastes* Stål. The bi-

[33] The internal on one of the former shows traces of a spine base.

spinose dorso-caudal margins of the median tibiae agree instead with *Aemasia* Brunner, from which genus, however, the present insect is very widely distinct.

Other characters of generic value are the following. Fastigium not narrowing beyond the lateral lobes above the ocelli, so that its contour is evenly narrowly shield-shaped; surface sulcate to near apex which is considerably surpassed by the antennal scrobes. Lateral facial carinae weak. Pronotum semicylindrical with surface rugulose. Tegmina and wings slightly reduced, the latter immaculate. Metasternal foveolae approximate. Femora sulcate ventrad, their ventro-cephalic margins armed; all genicular lobes armed with a minute spine except the external of the median femora, the internal of that limb with spine straight, the spines of the others incurved. Cephalic tibiae with auditory foramina conchate, not as flattened as in *Cocconotus;* dorsal surface flattened, unarmed. Median tibiae with dorsal surface similar but armed on caudal margin with two very small spines. Ovipositor slender for group, moderately recurved to the acute apex, with margins unarmed.

Chibchella personata new species (Pl. XXI, fig. 4.)

This sombre little insect may be recognized by the black face with small buffy markings, the finely maculate antennae and somewhat tessellate limbs, with femora darkened distad and pale annuli indicated in those areas.

Type.—♀; Cundinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1064.]

In addition to the characters given in the generic description, we note the following. Size small and form normal when compared with the species of *Cocconotus,* the general appearance much more like that genus than *Bliastes* Stål. Distal margins of first antennal joint produced internally as a blunt spine, above which is a small tubercle on the second joint. Surface of pronotum irregularly rugulose rather than tuberculate, the first and principal sulci deep, the latter showing scarcely any convexity caudad. Tegmina and wings briefly surpassed by the caudal femora. Subgenital plate very slightly broader than long, its lateral margins strongly convergent and very broadly convex to the small, bluntly acute-angulate, produced apex. Ovipositor stout at base, thence narrow and evenly and weakly recurved, the lateral surfaces showing mesad in distal portion (about 5) short vertical ridges. Subgenital plate broad and convex, the lateral margins straight and convergent to the small produced apex, which is rounded acute-angulate.

Occiput and dorsal surface of pronotum blackish mummy brown. Eyes buffy. Face shining black with a pair of short, straight, narrow lines of buff mesad which diverge slightly ventrad, below these two more widely separated linear flecks of buff and between a short, median, vertical band of buff which runs into the buff clypeus and labrum. Mandibles buff, with black internal margins and tips. Genae buffy, becoming brown dorsad. Antennae with first joint ochraceous tawny tipped with blackish mummy brown, second joint entirely dark, other joints ochraceous tawny each suffused dorso-distad with blackish mummy brown, these markings becoming more extensive distad. Sides of pronotum dresden brown, pleura tinged with mummy brown, abdomen cinnamon brown. Tegmina deep uniform mars brown, veinlets proximad in marginal field and distad at sutural margin inconspicuously paler, brownish buff, a trace of this also in discoidal field. Ovipositor ochraceous buff, becoming solidly hays russet mesad and distad deepening to liver brown. Femora buckthorn brown, tessellate with a darker shade, particularly the median femora, all suffused with mummy brown distad, a buffy annulus interrupting this but distinct only on the cephalic femora; spines buffy with apices darkened. Tibiae buckthorn brown flecked with buffy, the dorsal surfaces particularly of the cephalic tibiae almost solidly suffused with dark brown.

Length of body 25.8, length of pronotum 6, caudal width of pronotal disk 3.8, length of tegmen 24.7, greatest tegminal width 6.3, length of cephalic femur 10, length of caudal femur 22.7, length of ovipositor 16, median width of ovipositor 1.9 mm.

BRACHYAUCHENUS Brunner

We have been obliged to give this genus and the following species more consideration than is usually necessary, as Brunner's key in his Monograph is plainly unsatisfactory, and it is not only difficult to locate material properly as to the genus but even more disconcerting to attempt to verify the generic position of many of the described species.

The present genus is clearly very near *Cocconotus* Stål, the general appearance of the species closely resmbling that of the smaller, more compact forms assigned to that genus. In armament of the genicular lobes of the femora, reference to the species described below shows that closer agreement with *Bliastes* Stål is found in this feature.

In Brunner's key the position of *Brachyauchenus* is misleading, the pronotum being more thickly and coarsely granulose than is usual in *Cocconotus*, but not as acutely so as in *Choeroparnops*. It should, therefore, apparently run near *Triencentrus*, from the description of which we find a difference only in the median tibiae, which in that genus have the dorso-caudal margins armed.

Brachyauchenus magdalenae new species (Pl. XXI, figs. 5 and 6.)

This insect is less heavy than *B. castaneus* Brunner,[34] but similarly has the face, mandibles and coxae immaculate, the mesosternum and metasternum being darkened in the darker specimens. The femoral spines are all blackish brown with a pale preapical annulus.

Compared with a Peruvian male of *B. amoenus* Brunner, in the Academy Collection, that insect is seen to be slightly more compact, with the pronotal granules more prominent, the metzona proportionately wider, the styles slender and of equal width throughout and the limbs shorter and heavier.

Type.—♂; Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia. November, 1917. (M. A. Carriker Jr.) [Hebard Collection, Type No. 1061.]

Size medium, form less heavy and compact than is usual in this genus. Fastigium triangular, sulcate, shorter than antennal scrobes, with convexities above lateral ocelli moderately developed. First antennal joint with distal margin armed internally with a sharp, heavy tooth. Face polished, with scattered impressed punctae. Pronotum evenly and thickly granulate, convex, with mesonotum in narrow area and all of metanotum flattened, sulci deep; mesonotum equal to about two-fifths pronotal length. Tegmina and wings of equal length, slightly surpassing apices of caudal femora. Tegmina tapering to the rather sharply rounded apices; veinlets very thickly and evenly distributed and rather heavy, occupying all of the exposed portions of the stridulating area, the veins not conspicuous. Metasternal foveolae more distant from each other than from the lateral margins of the metasternum. Ultimate tergite much as in *amoenus*, with margin broadly concave above the broadly rounded triangular supra-anal plate, which is broader than long. Cerci as in that species; short, straight, roundly enlarged distad with internal surface flattened, armed with a very small but stout tooth on internal surface of terminus of flattened area. Subgenital plate broader distad than in *amoenus*, apex slightly surpassed by cerci, U-emarginate between the elongate, slightly incurved, paddle-

[34] See Monogr. der Pseudophyll., pl. 7, fig. 73, (1895).

shaped styles. These styles are slightly widest meso-distad, the internal surfaces flattened, the external feebly convex, each nearly twice as long as the width between their bases. Ventro-cephalic margins of femora armed with heavy spines (in the series as follows; cephalic 3 to 5, median 3 to 4, caudal 7 to 8). Femoral genicular lobes armed as follows: cephalic both usually with a minute incurved spine, which occasionally is absent; median unarmed externally, with a small straight spine internally; caudal both with a very small incurved spine. Cephalic tibiae with dorsal surface deplanate, unarmed. Median tibiae with dorsal surface deplanate, unarmed, with lateral margins slightly raised.

Allotype.— ♀ ; same data as type, but taken in October. [Hebard Collection.]

Agrees with male except as follows. Size larger, form robust. Ovipositor heavy, dorsal margin finely serrulate and straight, ventral margin smooth, broadly convex meso-distad, thence straight to the acute apex. Subgenital-plate small, triangularly emarginate at immediate apex, the lateral angles rounded. Limbs very similar to male except that the dorso-internal margin of the cephalic tibiae is slightly raised and in one paratype there is a single small spine on the dorso-internal margin of one of the median tibiae.

Male discolored, pale; females dark brown, the caudal femora with a mesoproximal and pre-genicular vague and only slightly paler transverse marking. Femoral spines blackish brown with a buffy subapical annulus, the dark coloration often spreading as a brief suffusion at the base of each spine. In one female the tegminal margins and some of the veins for a brief distance are paler, as figured for *castaneus*, this increasing the dried foliaceous appearance of the insect. Ovipositor cinnamon with margins broadly chestnut brown beyond the median point.

Measurements (in millimeters)

	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of cephalic femur	Length of caudal femur	Length of ovipositor
♂								
Vista Nieve. *Type.*	25.5	6.8	3.9	23.4	6.3	9	17.8	
♀								
Vista Nieve. *Allotype.*	27	7.8	5.5	28.2	7.7	10.1	21	17.2
Cincinnati. *Paratype.*	32.4[35]	7.1	4.6	28.3	7.5	9.9	19.8	16.4
San Lorenzo. *Paratype.*	30.3[35]	6.9	4.3	27	7.3	9.7	19.7	16.7

[35] Abdomen distended.

Specimens Examined: 4; 1 male and 3 females.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July, 1913, (M. A. Carriker Jr.), 1 ♀, *paratype.*

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, October and November, 1917, (M. A. Carriker Jr.), 1 ♂, 1 ♀, *type* and *allotype.*

Sierra San Lorenzo, Magdalena, August 23, 1913, (M. A. Carriker Jr.), 1 ♀, *paratype.*

Brachyauchenus difficilis new species (Pl. XXI, figs. 7 and 8.)

This insect adds to the evidence that such genera as *Triencentrus* Brunner and *Brachyauchenus* Brunner are very close to *Cocconotus* Stål, though widely separated in his key.

The present species has the metasternal interspace narrower than in *B. magdalenae* here described, thus showing still greater convergence toward *Cocconotus*, in which genus close agreement is found with the western Ecuadorean *C. atrifrons* Brunner in form and in the moderately recurved ovipositor. The armament of the femoral genicular lobes apparently agrees closely with that of *B. atrosignata* Brunner, being aberrant for this genus and closely resembling that of *C. atrifrons*, though production of the internal genicular lobe of the cephalic femora was considered by Brunner to be characteristic of *Bliastes* Stål, distinguishing that genus from *Cocconotus.*

In addition to differences in the metasternal lobes and armament of the femoral genicular lobes, this insect is distinguished from *magdalenae* by the facial coloration, the large tubercle present mesad on the cephalic margin of the pronotum; the male with tapering cerci rounded distad, subgenital plate much more produced with apex truncate and not emarginate and styles simple and very much smaller; the female with ovipositor moderately recurved and subgenital plate not emarginate distad. The general appearance is also distinctly more Cocconotoid.

Type.—♂; Cauca, Colombia. (F. Bonis.) [Acad. Nat. Sci. Phila., Type No. 5430.]

Size and form much as in *magdalenae;* more compact and with even shorter limbs than in *Cocconotus atrifrons.* Fastigium triangular, sulcate, projecting as far as antennal scrobes, with convexities above lateral ocelli decided. First antennal joint with distal margin armed internally with a sharp, heavy tooth. Face polished, with scattered impressed punctae. Pronotum evenly and thickly granulose, the granules slightly coarser than

in *magdalenae*, decidedly coarser than in *Cocconotus atrifrons*, with a decided tubercle mesad on cephalic margin, this also coarser than in that species; surface convex, with discal flattening caudad slightly less marked than in *magdalenae;* first sulcus deep, principle sulcus very deep, mesonotum equal to slightly over two-fifths pronotal length. Tegmina and wings of equal length, slightly surpassing apices of caudal femora. Tegmina tapering to the rounded apices which are broader than in *magdalenae;* veinlets very thickly and evenly distributed and rather heavy, exposed stridulating area opaque, the veins not conspicuous. Ultimate tergite with margin broadly concave between the cerci. Cerci short, stout, very feebly incurved, weakly tapering to the large rounded apex; mesad on which is situated a small, stout, uncinate tooth, directed slightly caudad of mesad. Subgenital plate strongly produced beyond apices of cerci, the lateral margins converging, this weak distad, apex very broadly obtuse-angulate produced between the simple, straight, cylindrical, rather elongate styles, which in length equal the distance between their bases, these styles very much smaller and more simple than in *magdalenae.* Ventro-cephalic margins of femora armed with heavy teeth (in the series: cephalic 4 to 5, normally 4; median 3 to 5, normally 4; caudal 6 to 9, normally 8, the first 2 usually small). Femora genicular lobes armed as follows: cephalic rounded, the internal alone with a small blunt spine; median and caudal rounded, the internal alone with a large and very feebly incurved spine. Cephalic and median tibiae deplanate and unarmed dorsad, the margins showing only a trace of elevation.

Allotype.— ♀ ; same data as type. [Acad. Nat. Sci. Phila.]

Agrees with male except as follows. Size larger, form robust. Ovipositor heavy, dorsal margin very weakly serrulate, showing very broad and feeble concavity, ventral margin smooth, broadly convex meso-distad to the acute apex. Subgenital plate proportionately larger than in *magdalenae*, triangularly shield-shaped with apex sharply rounded, its surface deplanate over a large median portion.

General coloration prouts brown, the occiput, genae, pronotum and femora tinged with russet. Face and cephalic surfaces of proximal antennal joint shining blackish chestnut brown, the labrum and clypeus forming a roughly circular area of cinnamon buff with a weak tawny ringe, this paler area with a median fleck of blackish chestnut brown.[36] Femoral spines blackish brown

[36] A specimen of *Cocconotus atrifrons* from the Rio Pescado, Ecuador, in the author's collection, shows identical facial markings. In that species decided variability is found in the facial markings, this being very different from the usual type.

with a buffy pre-apical annulus. Tibiae tawny-olive (a paler and less reddish brown). Ovipositor cinnamon, with margins broadly chestnut brown beyond the median point.

Measurements (in millimeters)

	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of cephalic femur	Length of caudal femur	Length of ovipositor
♂								
Type.	30	7.9	4.2	29.2	7.3	9.2	18	
♀								
Allotype.	33	8.3	4.7	30	8	10	19.3	17
Paratype.	30	8	4.4	27.7	7.2	10.3	19.3	15.4
Paratype.	29.5	8.2	4.7	27	8	10	18.8	15.9

These four specimens all bear the same data, "Cauca" being used in the extensive territorial sense customary at a time prior to the present division of Colombia into departments and intendencias.

Cocconotus innotatus (Walker)

1870. *Meroncidius innotatus* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 452. [♂; Bogota,[37] [Colombia].]

1895. *Cocconotus ignobilis* Brunner, Monogr. der Pseudophyll., p. 210. [♂, ♀; Venezuela and Colombia.]

The series before us, compared with the descriptions of Walker and Brunner, show the latter's synonym conclusively.

Viota, Cundinamarca, 1300 meters, August 19, 1914, (from A. Maria), 1 ♀.

Paime, Cundinamarca, 1000 meters, 1924, (from A. Maria), 1 ♀.

Las Mesitas, Cundinamarca, December, 1914, (from A. Maria), 10 ♂, 5 ♀.

Pacho, Cundinamarca, June 2, 1917, (from A. Maria), 2 ♀.

Villavicencio, Intendencia del Meta, June, 1919, (from A. Maria), 1 ♀.

The species, though of a very uniform brown coloration with black femoral spines, is distinctive in numerous structural features. In general appearance closer similarity to species we refer to *Brachyauchenus* Brunner is found than to those of the Degeeri Group which includes the genotype of *Cocconotus* Stål.

[37] Probably from a nearby locality at a lesser elevation.

The very elongate male cerci and straight ovipositor may, with other characters, serve to separate this and allied species from that genus, at the present time apparently a composite of several distinct phyla.

In the present series the spines of the dorso-internal margins of the median tibiae vary from four to six. In the Villavicencio female the organs of flight surpass the caudal femora by a much greater distance than in the others.

Cocconotus carmelitae[38] new species (Pl. XXI, figs. 9 and 10.)

This interesting, uniformly colored insect has no close relatives among the described species, except perhaps the Peruvian *C. similis* Caudell, known only from the female, which has the subgenital plate deeply cleft and the internal genicular lobes of the caudal femora armed with a spine.

The specialization of the apex of the male subgenital plate and recurved ovipositor indicate affinity to the more graceful and strikingly marked genotype *C. degeeri* (Stål) and its allies. The general appearance is slightly more Bliastoid, but we feel convinced that *carmelitae* is a true *Cocconotus*, even should the genus be much more restricted than it is at present.

Type.—♂; Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia. November, 1917. (M. A. Carriker Jr.) [Hebard Collection, Type No. 1062.]

Size below average, form moderately robust for the genus. Fastigium much as in *degeeri*, except that the swellings above the lateral ocelli are slightly broader; its size very small with minute acute apex not reaching as far as the antennal scrobes. Proximal antennal joint unarmed disto-internally. Pronotum very finely and thickly granulose, not almost smooth caudad on lateral lobes as in *degeeri;* sulci distinct. Tegmina and wings produced well beyond apices of caudal femora. Ultimate tergite depressed before the rounded-triangular supra-anal plate, which is slightly broader than long. Cerci short and heavy, moderately incurved, externally convex to the bluntly rounded apex, internally weakly concave to a subapical triangular production, the terminal spine of which is directed meso-proximad, this produced portion with dorsal surface weakly concave, which area includes the inner portion of the cercal apex. Subgenital plate strongly and narrowly produced, the lateral margins coarsely carinate to the

[38] Named in honor of Mrs. M. A. Carriker, Jr., who, with her husband, has secured many of the most interesting forms of the fauna of Colombia, both at home and in the field.

apex, which terminates in four rounded projections, between the lateral two of these are inserted the small, nearly oval styles, the very small interval between them U-emarginate. Limbs short for the genus. Femoral genicular lobes rounded, only the internal of the median armed with a very small spine. Ventro-cephalic margins of cephalic and median femora armed with a few (2 to 4 in series) spines, of caudal femora with (4 to 6, normally 5) rather small spines, smaller than in *degeeri*. Dorsal surface of cephalic and median tibiae unarmed.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with the male except as follows. Size somewhat larger. Ovipositor stout, weakly recurved, with apex acute, lateral surfaces of dorsal valves showing disto-ventrad three very sharp, short, vertical ridges; dorsal margin for some distance and ventral margin very briefly finely serrulate. Penultimate sternite unspecialized. Subgenital plate rounded-triangular, with a minute, shallow, apical emargination.

General coloration uniform ochraceous tawny, more brilliant on face and limbs than elsewhere. Ovipositor deep bay, with proximal portion and median third mesad buffy. Jaws and apex of clypeus dark brown. Veinlets of tegmina slightly paler than ground color, this sufficient to be noticeable only in proximal portion of marginal field. Femoral spines and those of caudal tibiae blackish, of cephalic and median tibiae dark brown. Tibiae flecked with black proximad and cephalic tibiae with auditory foramina finely marked with black at its base and apex.

The measurements of the type and allotype are followed by those of the largest paratypic male and the smallest paratypic female. Length of body ♂ 29.2 and 37.2, ♀ 38.3[39] to 29.7; length of pronotum ♂ 6.8 and 6.8, ♀ 7.8 to 7.1; caudal width of pronotal disk ♂ 3.7 and 3.8, ♀ 4.8 to 4; length of tegmen ♂ 30.8 and 31, ♀ 34.3 to 31.7; width of tegmen ♂ 5.8 and 6, ♀ 6.8 to 6.7; length of cephalic femur ♂ 10.1 and 10, ♀ 10.7 to 9.9; length of caudal femur ♂ 16.9 and 18.7, ♀ 20.3 to 19.3; length of ovipositor 18.1 to 17 mm.

Specimens Examined: 6; 2 males and 4 females.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July, 1913, (M. A. Carriker, Jr.) 1 ♂, *paratype;* at 4500 feet August, 1920, (R. Sargent), 1 ♀, *paratype.*

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, November, 1917, (M. A. Carriker, Jr.), 1 ♂, 3 ♀, *type, allotype, paratype.*

[39] Abdomen distended.

Cocconotus degeeri (Stål)

1860. *Meroncidius degeeri* Stål, Kongl. Svenska Freg. Eugenie's Resa, Zool., I, p. 322. [♀; San José Island, [Pearl Islands,] Panama.]

Boca Murindó, Chocó, February 9, 1918, (M. A. Carriker Jr.), 1 ♂.

This specimen shows an optimum development for the species, as indicated by a Panamanian series which we plan to discuss shortly. The five vertical facial bands are decided and sharply defined. It measures; length of body 43.3, length of pronotum 8.8, caudal width of pronotal disk 4.8, length of tegmen 45.1, greatest tegminal width 8.8, length of cephalic femur 11.3, length of caudal femur 24 mm.

Cocconotus aratifrons Brunner

1895. *Cocconotus aratifrons* Brunner, Monogr. der Pseudophyll., p. 206. [♂, ♀; Colombia.]

La Palmeta, Santander, 7500 feet, July 15 to 20, 1916, (M. A. Carriker Jr.), 1 ♀.

A series before us of *C. vittagenae* Bruner, from the lowlands of Magdalena is, in the female sex, separable from this specimen only by the form of the supra-anal plate and apparently certain differences in size. The dimensions of the present female lie between the extremes for that sex as given by Brunner. It is possible that more than one species was there confused, and definite specific assignment can therefore not be made until a single type from the original series is selected and the supra-anal plate described.

The occiput and pronotum is less darkened in this specimen than is usual in *degeeri*, to which it is closely related, while in both species the tegminal veinlets in the proximal portion of the marginal field are greenish.

Cocconotus pollonerae Griffini

1896. *Cocconotus pollonerae* Griffini, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XI, No. 232, p. 22. [♀; Lake Pita, Darien [, Panama].]

Andagoya, Antioquia, April 22, 1918, (M. A. Carriker Jr.), 1 ♀.

This individual agrees closely with Griffini's satisfactory description except in having the face almost immaculate and in lacking a tubercle mesad on the cephalic margin of the pronotum. It is also apparently quite closely related to the genotype, *degeeri* (Stål), though the face is immaculate and the femoral

spines are pale. Males from Darien and the Colombian Chocó may show the presence of more than one species of this type.

The species apparently averages slightly larger and more slender than *C. aratifrons* Brunner, which in turn averages slightly larger and more slender than *degeeri*. Length of body 44.5, length of pronotum 7.9, caudal width of pronotal disk 4, length of tegmen 49, greatest tegminal width 8.9, length of cephalic femur 13.8, length of caudal femur 29.2, length of ovipositor 22.2 mm.

Cocconotus apolinari new species (Pl. XXI, fig. 11.)

Generic separation may be found necessary for this and other species now referred to *Cocconotus*, which have the dorso-caudal margin of the median tibiae armed with spines, the male subgenital plate simply but deeply emarginate at its apex and the styles more elongate than in the known related species.

This handsome insect is very closely related to the Ecuadorean *C. adustus* Bolivar, differing only in the shorter organs of flight and limbs, absence of vertical dark margins of the face and pronotal lateral lobes, slightly more numerous femoral spines, which are similarly black but have a suffusion of the same about the base of each and tibial spines not paler but equally dark with similar basal suffusions.

This may indicate racial rather than specific differentiation, but such, from our knowledge of the species of the Degeeri Group, does not appear probable, though the present is a very distinct phylum.

Type.— ♀ ; Villavicencio, Intendencia del Meta, Colombia. 1922. (From A. Maria.) [Hebard Collection, Type No. 1077.]

Size medium large, form normal for the genus. Head globose, smooth. Fastigium much as in *C. degeeri* (Stål) but more produced, so that its minute acute apex reaches as far as the antennal scrobes. Proximal antennal joint armed disto-internally with a small spike. Pronotal disk very finely and thickly granulose, this on the lateral lobes weaker cephalad and almost obsolete elsewhere; sulci decided. Metasternal foveolae forming a single orbicular transverse fovea. Tegmina and wings briefly produced beyond apex of ovipositor. Supra-anal plate rounded, slightly broader than long, with dorsal surface decidedly concave mesad. Ovipositor broad; ventral margin very broadly convex distad to the acute apex, subserrulate near apex; dorsal margin with an appreciable though broad and rounded obtuse-angulation meso-distad, faintly concave before this, thence oblique to the apex, serrulate from slightly before that point to apex, these ser-

rulations more decided than in *degeeri;* lateral surfaces smooth, the dorsal valves distad with five (and traces of more) short oblique ridges. Penultimate sternite unspecialized. Subgenital plate produced in a small rounded lobe dorsad on each side, the distal margin truncate between these with a U-shaped median emargination, the very small lateral apices so formed acute and slightly produced. Limbs of normal length. Femoral genicular lobes rounded, only the internal of the median and caudal femora armed with a spine. Ventro-cephalic margins of cephalic and median femora armed with moderately heavy spines (2 or 3), of caudal femora with heavier spines (5 and 7), which are slightly heavier than in *degeeri.* Dorso-internal margin of median tibiae armed with two very small spines.

General coloration ochraceous tawny. Antennal scrobes, three proximal antennal joints, apex of facial fastigium, all of fastigium, occiput, disk of pronotum and anal field of tegmina continued along sutural margin for some distance, blackish brown. Face light ochraceous tawny. Genae and lateral lobes of pronotum paler and more buffy, immaculate. Other portions of tegmina with a few scattered areolae of blackish brown, which lack the elsewhere close network of veinlets. Wings weakly and evenly suffused with mummy brown, the veins slightly darker, but marginal field very faintly tinged with buckthorn brown, the veins there buckthorn brown. All ventral spines of femora and tibiae black with a suffusion of the same at their bases, their apices russet.

The unique female type measures; length of body 28, length of pronotum 7.8, caudal width of pronotal disk 4, length of tegmen 40, width of tegmen 9.8, length of cephalic femur 12, length of caudal femur 24.5, length of ovipositor 20, width of ovipositor at meso-distal angulation 4 mm.

EUCOCCONOTUS new genus

This genus is erected to include *annulatus* here described and *Cocconotus aethiops* Brunner, of which the former is the genotype.

Tubercles instead of spines on the dorsal margins of the cephalic and median tibiae constitute one of the outstanding features of difference from *Cocconotus* Stål, but such is not exhibited to the extent that it is developed in *Nastonotus* Bolivar, a genus related to *Bliastes* Stål.

The genotype shows further differences from *Cocconotus* in form of the fastigium, which has the lobes above the ocelli lower and longer and slightly divergent cephalad, resulting in the small apical portion being broader proximad and thus only slightly longer than its proximal width; the pronotum with tubercles more decided; the tegmina with interval between humeral and

discoidal veins more nearly equal throughout (not distinctly wider proximad) and the internal genicular lobe of the caudal femora spined. Known only from the female sex, the males may show genitalic differences of generic significance, though the females do not appear to do so.

These genera agree as follows. Fastigium small, its apex not reaching as far as the antennal scrobes. Lateral facial carinae very weakly indicated. Tegmina narrow, wings immaculate. Metasternal foveolae approximate. Femora sulcate ventrad, their ventro-cephalic margins armed; genicular lobes of cephalic and external of median and caudal femora unarmed. Dorsal surfaces of cephalic and median tibiae deplanate, margins usually subcarinate. Auditory foramina of cephalic tibiae flattened conchate. Ovipositor rather broad, moderately recurved to the acute apex, with margins finely serrulate distad.

Eucocconotus annulatus new species (Pl. XXII, figs. 6 and 7.)

This strikingly beautiful species may be easily distinguished from *E. aethiops* (Brunner), described from the same locality, by its much more contrasting coloration, particularly of the head and limbs and its longer limbs and ovipositor. Discovery of the males of these species will very possibly show important genitalic differences.

Type.— ♀ ; Medellin, Antioquia, Colombia. April, 1913. (From A. Maria.) [Hebard Collection, Type No. 1063.]

In addition to the characters given in the generic description, the following appear to be of specific importance. Size medium large and form rather slender compared with the species of *Coconotus*. Fastigium deeply sulcate between lobes above lateral ocelli and briefly in apical portion. Disto-internal margin of first antennal joint rounded-triangularly produced, above which is a small tubercle on the second joint. Pronotum with surface thickly supplied with prominent tubercles, the first and principal sulci deep. Tegmina and wings surpassing apices of caudal femora. Ultimate tergite roundly-angulate emarginate at slightly more than ninety degrees above the very small, rounded supra-anal plate, which is broader than long. Ovipositor with distal half of dorsal margin and apical portion of ventral margin very finely serrulate; lateral surfaces with a few, irregularly placed, short ridges distad at the dorsad margin and a few small nodes mesad below these. Subgenital plate broad, apex with a moderately large, concave emargination. Ventral femoral margins armed with spines as follows; cephalic-internal 2 and 3, median-external 1 and 1, caudal external 5 and 6. Femoral genicular lobes with median and caudal internal alone armed

with a small straight spine. Important specific features are shown by the coloration of this species.

Occiput and pronotum solidly tawny. Face, labrum and dorsal half of clypeus light ochraceous buff, the face evenly tinged with tawny, this pale area surrounded by black which includes a broad subocular band suffused caudad, the antennal scrobes, fastigia, jaws and distal half of the clypeus. Antennae entirely black. Postocular portions of genae cinnamon brown, becoming ochraceous buff ventro-caudad. Pleura and abdomen buckthorn brown, the former marked with blackish brown. Tegmina dresden brown, with veinlets of marginal field and along sutural margin buffy. Wings evenly suffused, avellaneous, transparent. Ovipositor buffy beyond base which is brown, thence tawny mesad with remaining lateral and distal portions blackish chestnut. Femora amber brown becoming blackish brown distad, each with this apical dark area broken by a broad and sharp annulus of ochraceous buff; spines blackish, those of the caudal femora pre-apically dark brown. Tibiae ochraceous buff, the spines and their bases dark brown, as are the margins and the area between the openings of the auditory foramina of the cephalic tibiae.

Length of body 31, length of pronotum 7.8, caudal width of pronotal disk 4.7, length of tegmen 39, greatest tegminal width 8, length of cephalic femur 13.1, length of caudal femur 27.7, length of ovipositor 20.7, median width of ovipositor 3.8 mm.

The type of this beautifully marked insect is unique.

Nannotettix elongatus Brunner

1895. *Nannotettix elongatus* Brunner, Monogr. der Pseudophyll., p. 214, pl. 8, fig. 91. [♀, Colombia.]

La Pica, Santander, 9000 feet, February 10 to 15, 1917, (M. A. Carriker Jr.), 1 ♂, 1 ♀, 1 juv. ♂, 1 juv. ♀.

Choachi, Cundinamarca, September, 1918, (from A. Maria), 1 ♀.

These specimens appear to represent *elongatus*, the male agreeing with the very unsatisfactory original description in general proportions and color, but having the tegmina more reduced, very broadly rounded subtruncate rather than lanceolate. Additional material may show this to be an index of specific distinction.

We further believe that the genus should be restricted, probably to include only the first two species referred to it by Brunner, both of which are Colombian. These are Cocconotoid, while we have Bolivan and Argentinian forms before us which are quite as distinctly Teleutioid and clearly derivatives from a very different stock.

The male here recorded is smaller than the female from the same locality, with tegmina and wings considerably reduced, though much less so than in that sex, failing to reach the apices of the caudal femora by a short distance. The ultimate tergite is truncate, depressed meso-caudad. The supra-anal plate is small, rounded-triangular, longer than wide, with dorsal surface deeply concave. The cerci are rather small, straight and cylindrical to their blunt apices, which are triangularly produced internally at a right-angle to the shaft, that portion flattened above and below and terminating in a small, stout tooth. The subgenital plate is not strongly produced, U-emarginate distad between the style sockets. In this specimen the styles are missing, but the immature male indicates that in the adult they are probably simple, rather elongate and slender.

The measurements of the La Pica female are followed by those of the female from Choachi. Length of body ♂ 25.7, ♀ 26.8 and 21.8, length of pronotum ♂ 4.7, ♀ 5.1 and 4.7; caudal width of pronotal disk ♂ 2.7, ♀ 2.8 and 2.7; length of tegmen ♂ 15, ♀ 4.8 and 3.8; width of tegmen ♂ 4.6, ♀ 3.1 and 2.9; length of caudal femur ♂ 14.7, ♀ 15.7 and 13.8; length of ovipositor 12.8 and 10.7 mm.

The coloration of these specimens further indicates that we have here either a quite variable species or representatives of more than one closely allied forms. The male has the antennae immaculate, but in the females and immature individuals they are finely and somewhat irregularly annulate with dark brown. The females show beautiful zig-zag markings dorso-laterad on the abdomen, this decidedly stronger in the Choachi individual. The femora, and particularly the caudal pair, become darker distad and in this area a buffy annulus is indicated. This marking is strong in the La Pica female and reduced to a mere trace only in the adult La Pica male.

Nannotettix spissus Brunner

1895. *Nannotettix spissus* Brunner, Monogr. der Pseudophyll., p. 214. [♀; Bogotá [, Colombia].]

Muzo, Boyacá, 1922, (from A. Maria), 1 ♀.

Bogotá, Cundinamarca, August 9, 1917 and December, 1915, (from A. Maria), 3 ♂, 1 ♀.

The previously unknown male agrees closely with that here described under *N. elongatus* Brunner, except in the very small size, great tegminal reduction, cerci which are bent inward distad at an obtuse angle and subgenital plate, the emargination of which is rounded-rectangulate.

The occiput and pronotum is suffused medio-longitudinally with dark brown; this, unlike in *elongatus*, sometimes resolving

itself into a well defined stripe on the latter. The antennae and limbs are immaculate, except the caudal femora, which show mere traces of the markings here described for *elongatus*.

Length of body ♂ 18.3, ♀ 20.5; length of pronotum ♂ 4, ♀ 4.7; caudal width of pronotal disk ♂ 2, ♀ 2.7; length of tegmen ♂ 3.3, ♀ 3.7; width of tegmen ♂ 3.1, ♀ 2.9; length of caudal femur ♂ 10.1, ♀ 11.7; length of ovipositor 10.3 mm.

This is one of the smallest known species of the Pseudophyllinae.

Rhodopteryx elongata Vignon (Pl. XXII, figs. 8 to 11.)

1924. *Rh[odopteryx] elongata* Vignon, Bull. Mus. Nat. Hist. Nat. de France, 1924, p. 307. [♀; Darien, Panama: ♂; Cundinamarca, Colombia.]

Muzo, Boyacá, January, August and September, 1915, 1918 and 1920, (from A. Maria), 2 ♂, 2 ♀.

The rose-colored wings with heavy markings of blackish brown make this one of the most beautiful species of the Pseudophyllinae. The males here recorded are considerably darker than the females, one of the latter having the dark wing markings considerably reduced.

Cycloptera fagifolia (Saussure and Pictet)

1898. *Chlorophylla vagifolia* Saussure and Pictet, Biol. Cent.-Amer., Orth., I, p. 456, pl. 13, fig. 18. [♀, Ecuador.]

Muzo, Boyacá, May, 1918, (from A. Maria), 1 ♀.

Comparison of this great, green, leaf-like katydid with a female of the genotype, *C. aurantifolia* (Stoll), convinces us that these species are congeneric. It is very possible that *Chlorophylla* Pictet will be found to be a synonym of *Cycloptera* Serville.

Copiphorinae

Caulopsis microprora new species (Pl. XXI, fig. 12.)

Though recent studies have shown that there is considerable individual variation in size and form of the fastigium in *C. cuspidata* (Scudder),[40] the present series, including all material of the genus from Panama and Colombia, has this process consistently so much smaller and more acute that, combined with the longer ovipositor, we feel that it should be recognized as a distinct species. The males also average distinctly smaller than in *cuspidata*, though the females average larger.

[40] Of which we have found *C. prora* (Scudder), based on a female from Nicaragua, to be a synonym; Trans. Amer. Ent. Soc., LI, p. 300, (1925).

The male genitalia are identical in these two species, though in a related Guianan species, which we recognize as *C. sponsa* (Stoll), the male ultimate tergite, cerci and subgenital plate are distinctive. That species averages even smaller and distinctly more slender than *microprora*, the size difference between the sexes being similarly more pronounced than in *cuspidata*. Redtenbacher's and Karny's records of *cuspidata* are almost certainly referable to *sponsa*, the fastigium in those species being extremely similar. We believe *cuspidata* is confined to tropical North America and the West Indies, *sponsa* to northeastern South America.

Type.—♂; Aracataca, Magdalena, Colombia. August 8, 1920. (M. Hebard.) [Hebard Collection, Type No. 1066.]

Generally similar to *cuspidata*. Size of this sex distinctly smaller, form similar. Fastigium smaller, tapering evenly and gradually to the rather sharply rounded apex, with sides not parallel in proximal portion as is usual in *cuspidata*. Head and pronotum similarly microscopically impresso-punctulate. Tegmina and wings very elongate, the former with stridulating area similar, rather ample considering the decided narrowness of the tegmina. Genitalia and limb armament similar to *cuspidata*. Ultimate tergite weakly acute-angulate produce laterad, the distal margin between broadly concave. Supra-anal plate deflexed, rounded trigonal, longer than broad. Cerci moderately stout, the distal crab-like claws bent inward with the dorsal curving over the ventral. Subgenital plate nearly rectangularly emarginate between the simple styles. Cephalic and median femora with genicular lobes and ventral margins unarmed, caudal femora with genicular lobes unispinose and ventral margins armed distad with small spines, these few on the internal margins.

Allotype.—♀; same data as type. [Hebard Collection.]

Size much larger than male, showing decidedly more contrast than in *cuspidata*, form slightly more robust. Ovipositor proportionately longer than in that species, slightly longer instead of being slightly shorter than the caudal femur, similarly proximad directed feebly dorsad, then expanding very feebly and showing a very broad, weak curvature ventrad. Subgenital plate similarly rather broadly truncate distad, with disto-lateral angles rounded.

General coloration a very clear delicate light green, sometimes showing weakly a postocular line of buff on each side, continued across the pronotum as lateral margins of the disk. Male stridulating field occasionally faintly suffused with light brown mesad and meso-caudad.

The size agreement in the male paratypes is very close, those from Boca Murindó and Cordoba being slightly smaller. Length of body ♂ 21.7, ♀ 29; length of pronotum ♂ 4.6, ♀ 5.4; caudal width of pronotal disk ♂ 2.7, ♀ 3.2; length of tegmen ♂ 30, ♀ 40; width of tegmen ♂ 3.7, ♀ 4.9; length of caudal femur ♂ 14.1, ♀ 17.8; length of ovipositor 19.3 mm. This species is clearly decidedly less variable than *cuspidata*, the extremes of the fastigial length, taken from the cephalic margin of the eye to its apex being; ♂ 2.8 to 2.9, ♀ 3.3[41] to 3.8 mm.

Specimens Examined[42] 24; 17 males and 7 females.

Medellin, Vera Cruz, Mexico, (Rev. T. Hyde), 1 ♀,[43] [Hebard Cln.].

Eden, Nicaragua, April 13 and June 4, 1922, (W. Huber; attracted to light), 1 ♂, 1 ♀, [A. N. S. P.].

San Ramon, Rio Wanks, Nicaragua, one hundred and eighty miles from Cape Gracias, elevation 375 feet, May and June, 1905, (M. S. Palmer), 1 ♂, [A. N. S. P.].

Gatun, Canal Zone, Panama, August 22, 1916, (D. E. Harrower), 1 ♀.

Barro Colorado Island, Gatun Lake, Canal Zone, Panama, July 19, 1924, (N. Banks), 1 ♂, [Mus. Comp. Zool.].

Limon Plantation, Rio Chagres, Panama, July 14, 1918, (Dietz and Zetek; in sweeping from corn field), 3 ♀, [U. S. N. M.].

Pinogana, Darien, Panama, December, 1915, (Muñoz), 1 ♂.

Boca Murindó, Intendencia del Chocó, Colombia, February 9, 1918, (M. A. Carriker Jr.), 1 ♂.

Aracataca, Magdalena, Colombia, August 8, 1920, (M. Hebard; taken at night with electric torch, a colony located in a few patches of sugar cane sprouts in one restricted area, individuals made little or no attempt to escape), 11 ♂, 1 ♀, *type, allotype, paratypes.*

Cordoba, El Valle, Colombia, May 23, 1918, (M. A. Carriker Jr.), 1 ♂.

Neoconocephalus productus Karny

1907. *Neoconocephalus productus* Karny, Revisio Conoc., p. 30. [♂, "St. Juez, (Andes Oriental)."]

Villavicencio, Intendencia del Meta, 1922, (from A. Maria), 1 ♀, brown.

[41] In one specimen only is the fastigium this short, the fastigial apex being, in this case, slightly deformed.

[42] In the material we have recorded as *cuspidata*, a single female, labelled "Honduras" agrees in ovipositor length with the female here recorded and not with Nicaraguan females clearly referable to *cuspidata*. As this is an old museum specimen, dried after immersion in alcohol, it is possible that the label is incorrect.

[43] We also have a specimen typical of *cuspidata*, bearing the same data. We have found that some of the material taken by T. Heyde to be incorrectly labelled so this can, unfortunately, not be taken as definite proof that both these species occur in Vera Cruz.

This specimen somewhat resembles females of *N. maxillosus* (Fabricius), differing in the longer fastigium, distinct antennal annuli, slightly more coarsely impresso-punctulate pronotum and much longer ovipositor, which does not widen appreciably beyond the meso-proximal constriction and shows no faint decurvature.

The much longer caudal femora than in the described males of *productus* might suggest the presence of a distinct species, but in undoubted material of *maxillosus* before us we find quite as great individual diversity in the caudal femoral length.

In this female the ventral portions of the fastigium are solidly black. The brown antennae have a number of minute darker annuli and distad several which are more conspicuous, formed by broader pale bands followed by darker bands of equal width. Such antennal annulation is also occasionally found in brown individuals from tropical America of species of this and the genus *Homorocoryphus* Karny, and apparently has little or no specific significance.

The present female measures; length of body 35, length of pronotum 8.2, length of tegmen 46.3, length of caudal femur 27, length of ovipositor 40, greatest width of ovipositor 1.6 mm.

Neoconocephalus maxillosus (Fabricius)

1775. [*Locusta*] *maxillosa* Fabricius, Syst. Ent., p. 284. [America.]
1881. *Conocephalus heteropus* Bolivar, Anal. Soc. Española Hist. Nat., x, p. 496. [♀; Itaparica, Brazil.]

Examination of the original description of *heteropus* and material so recorded by Rehn from Brazil, shows that name to be referable to the species we recognize as *maxillosus*.

Cordoba, El Valle, May 28, 1918, (M. A. Carriker Jr.), 1 ♀, (brown).

Susumuco, Cundinamarca, January, 1920, (from A. Maria), 1 ♀, (brown).

Villavicencio, Intendencia del Meta, February and July, 1918, 1920 and 1921, (from A. Maria), 4 ♀, (2 brown).

We know that the distribution of this species is very extensive in northern South America and that it reaches from Mexico and Jamaica to the Amazon.

Neoconocephalus affinis affinis (Beauvois)

1805. *Locusta affinis* Beauvois, Ins. Rec. Afr. et Amer., p. 219, pl. 7, fig. 5. [♀, San Domingo.]

1839. *Conocephalus guttatus* Serville, Hist. Nat. Ins., Orth., p. 518. [♀ Cuba.]

Beauvois' *affinis* was placed as a synonym of *maxillosus* (Fabricius) with a query, by Redtenbacher, and without reservation by Kirby. We find that the insect which has generally been recognized as *guttatus* (Serville) and *triops* (Linnaeus) are the two abundant forms found in San Domingo and that they alone are comparable with Beauvois' figure. Close examination shows that a female of the first of these was undoubtedly employed, and we are consequently obliged to synonymize under *affinis* the much later name *guttatus*.

Walker's *exaltatus*, described from Venezuela, is probably also a synonym.

Boca Murindó, Intendencia del Chocó, February 9, 1918, (M. A. Carriker Jr.), 3 ♂, 3 ♀, (green).

Andagoya, Antioquia, April 22, 1918, (M. A. Carriker Jr.), 2 ♂, 4 ♀, (green).

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July 10, 1913, (M. A. Carriker Jr.), 1 ♂, (green).

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, November, 1917, (M. A. Carriker Jr.), 1 ♀, (green).

Puerto Berrio, Antioquia, December, 1913, (from A. Maria), 1 ♀, (green).

Muzo, Boyacá, July, 1918, (from A. Maria), 2 ♀, (green).

Susumuco, Cundinamarca, August, 1917, (from A. Maria), 1 ♀, (green).

Villavicencio, Intendencia del Meta, February, 1920 and 1921, (from A. Maria), 5 ♂, 8 ♀, (1 ♂, 3 ♀ brown).

The present series shows considerable individual variability in form of the fastigium and amount of black on its ventral surface. The more slender females with least heavy fastigia are separable with difficulty from those of *maxillosus*, though usually, and always in the male sex, these species are easily distinguished. The pair from the Santa Marta region have the fastigium unusually small and rounded. Nominal recognition would appear to be essential, were the plasticity of this species not known.

Very small, widely spaced dark annuli are usually, but not always, present distad on the antennae.

We discuss next the more southern race of this species, *crassus*.

Neoconocephalus affinis crassus (Bolivar)

1881. *Conocephalus crassus* Bolivar, Anal. Soc. Española Hist. Nat., x, p. 499. [♀; Baeza, Ecuador.]

Cordoba, El Valle, May 23, 1918, (M. A. Carriker Jr.), 1 ♀, (green).

Villavicencio, Intendencia del Meta, July, 1918 and 1921, (from A. Maria), 4 ♀, (green).

Only extensive series from many widely separated localities enable us to decide the real value of Bolivar's *crassus*, under which we have recently synonymized Redtenbacher's *nigropunctatus*.[44] We there pointed out that Redtenbacher had incorrectly placed as *crassus* material of another species, showing still greater fastigial production, hence that author's synonym.

The Villavicencio females show a strong tendency toward typical *affinis*, that locality being evidently in an area of intergradation. The best racial evidence is, however, shown by two Venezuelan series before us, the first typical of *affinis* from San Esteban, the second from the Rio Mato, an affluent of the Rio Caura and south of the Orinoco. This latter series of three males and two females is intermediate, but somewhat nearer *affinis crassus*, showing that the southern race extends northward from the Guianas nearly to the Orinoco.

These two races are separable only by the distinctly greater fastigial production in *affinis crassus*. Though considerable individual variation occurs, typical series of these races show a constant decided difference in that feature.

The known northern limits of the present race are therefore defined by the material here recorded and that from the Rio Mato, Venezuela.

Neoconocephalus brachypterus Redtenbacher (Pl. XXII, fig. 12.)

1891. *Conocephalus brachypterus* Redtenbacher, Monogr. der Conoceph., p. 400. [♀, Brazil.]

1907. *Neoconocephalus vicinus* Karny, Revisio Conoceph., p. 34. [♂, ♀: Rio Grande do Sul, [Brazil]; Paraguay.]

After examining a series from Sapucay, Paraguay[45] and Chapada, Brazil and making comparisons with the original descriptions, we can find no features warranting the retention of *vicinus*.

[44] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 223, (1924).

[45] Recorded as *saturatus* (but referred in 1915 to *vicinus*) and *brachypterus* by Rehn in 1907, Proc. Acad. Nat. Sci. Phila., p. 390, and as *vicinus* Proc. Acad. Nat. Sci. Phila., 1920, p. 281.

The tegmina in that series vary decidedly in length, slightly surpassing the caudal femora to being fully caudate.

Cunday, Tolima, September, 1914, (from A. Maria), 1 ♀, (brown).

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀, (brown).

These specimens agree closely with Paraguayan material, differing only in their decidedly smaller size. Males may show specific difference, but this we believe is unlikely.

Length of body 27.2 and 27.3, length of fastigium (from basal tooth to apex) 1.3 and 1.4, length of pronotum 7.2 and 7.8, caudal width of pronotal disk 4 and 4.1, length of tegmen 29.7 and 28.8, length of caudal femur 20.4 and 21.8, length of ovipositor 30.2 and 30.3 mm.

This species is distinguished by the rather slender form, fastigium slightly longer than wide with sides parallel to the rather broadly rounded apex, often abbreviate tegmina and very long, nearly straight and scarcely widening ovipositor.

Neoconocephalus triops (Linnaeus)

1758. [*Gryllus* (*Tettigonia*)] *triops* Linnaeus, Syst. Nat., Ed. X, 1, p. 430. ["Indiis" (probably the West Indies).]

Quibdó, Intendencia del Chocó, September, 1896, 1 ♂, (brown), [A. N. S. P.].

Santa Marta, Magdalena, October, 1917, (M. A. Carriker Jr.), 1 ♂, (green).

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July, 1913, (M. A. Carriker Jr.), 2 ♂, 1 ♀, (♀ green).

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, November, 1917, (M. A. Carriker Jr.), 1 ♂, 1 ♀, (♀ green).

Mamatoco, Magdalena, December, 1917, (M. A. Carriker Jr.), 1 ♀, (green).

La Vega, Cundinamarca, 1100 meters, July 20, 1905, (from A. Maria), 1 ♂, (brown).

Las Mesitas, Cundinamarca, May, 1918, (from A. Maria), 2 ♂, (brown).

Providencia, (from A. Maria), 1 ♀, (green).

This insect is known northward to Oklahoma and the District of Columbia; southward material is before us from as far as Lima, Peru, while southeastward we have specimens from British Guiana.

We expect to give shortly, in a paper on Panama, further synonymy and data on this widespread species.

Homorocoryphus cocanus (Bolivar)

1881. *Conocephalus cocanus* Bolivar, Anal. Soc. Española Hist. Nat., x, p. 51. [♀; Coca, Ecuador.]

Las Mesitas, Cundinamarca, May, 1918, (from A. Maria), 1 ♂, (green).

Dark flecks are conspicuous at the bases of the ventral spines of the caudal tibiae as well as of the caudal femora in this species and the closely related *H. proximus* (Redtenbacher).

Length of body 27.7, length of fastigium (from basal point to apex) 1.2, length of pronotum 8, length of tegmen 38.7, length of caudal femur 21.9 mm.

Copiphora cornuta denticornis new subspecies (Pl. XXI, fig. 31.)

Typical *C. cornuta cornuta* (DeGeer), occurs in the Guanas, of which two pairs are now before us. The present race differs in the fastigium which is weakly but distinctly thickened subapically and quite as strongly acute-granulate dorsad as ventrad, the post-ocular portion of the genae and lateral carinae of face more strongly granulate, mouthparts separated dorsad from face by a decided black margin, tegmina distad with a fine border of pinkish brown and median tibiae usually with four instead of three dorso-caudal spines.

Specimens recorded as *cornuta* by Rehn, from Pará, Brazil, have the fastigium almost intermediate in form and granulation, the clypeo-facial suture weakly suffused, a similarly weaker tegminal border and the median tibiae armed with three to five dorso-caudal spines.[46] These specimens are best referred to as atypical *cornuta denticornis*, showing a strong tendency toward the typical race. Without them it would have appeared necessary to describe *denticornis* as a distinct species.

Type.— ♀; Susumuco, Cundinamarca, Colombia. January, 1920. (From A. Maria.) [Hebard Collection, Type No. 1070.]

Size small for the genus, form moderately robust. Fastigium swelling gradually distad so that it is subapically slightly thicker than mesad, thence in lateral aspect narrowing, by broadly rounding dorsad to the small apical spine; large acute granulations present dorsad except in a brief apical portion and the

[46] Four to five such spines are found in this series, however, except on one of the median tibiae of one specimen. The exact number of such spines is therefore clearly not a fixed specific quantity as Karny supposed and should not have been used without qualification in that author's key of 1907.

flattened proximal portion, medio-longitudinal dorsal sulcus distinct. Face and pronotum weakly rugulose, a decidedly granulose subocular ridge separating the genae from the face, the former moderately granulose. Tegmina and wings fully developed, far surpassing the caudal femora. Ovipositor very elongate. Subgenital plate cleft distad, the small lateral apices, unlike typical *cornuta*, embracing the ovipositor. Limb armament as in typical *cornuta* except as noted above.

Allotype.—♂; same data as type. [Hebard Collection.]

Agrees closely in ambisexual features with female, differing as follows. Stridulating field moderately ample, with stridulating vein prominent and very even. Ultimate tergite convex distad, showing a small median impression. Cerci small, cylindrical, suddenly bent inward distad, the distal portion more slender, terminating in two rounded knobs and meso-ventrad with a slender finger directed cephalad.

General coloration lumiere green. Ventral surface of fastigium, clypeus and labrum apparently buffy in life. Facio-clypeal suture heavily marked with black. Internal portion of mandibles black. Tegminal margins distad, particularly along costal margin, very narrowly vinaceous tawny, the discoidal field with traces of a few minute brownish flecks.

The measurements of the type are followed by those of two paratypic females from Villavicencio, Intendencia del Meta, taken September, 1918 and in 1922, from A. Maria. Length of body ♂ 37.5, ♀ 41, 39.5 and 45; length of fastigium (from apex of basal tooth to that of apical spine) ♂ 7, ♀ 7.8, 7.8 and 8.2; length of pronotum ♂ 9.2, ♀ 10.3, 10.2 and 10.7; length of tegmen ♂ 35.8, ♀ 40.8, 43.5 and 47.6; width of tegmen ♂ 9, ♀ 9.4, 9.7 and 10.2; length of caudal femur ♂ 16, ♀ 22, 22.7 and 24.8; length of ovipositor 41.7, 41.8 and 58.9 mm.

Copiphora colombiae new species (Pl. XXI, fig. 14.)

This insect superficially resembles the Bolivian *C. brevipennis* Bruner, but is actually nearest *C. capito* Stål, differing from the unsatisfactory original description of that species in the heavy tubercles of the coarse infra-ocular carinae and fewer spines of the dorso-internal margin of the median tibiae. From subsequent characterizations of that species the present insect is further distinguished by the carinate but not compressed ventral surface of the fastigium, the greater reduction of the organs of flight and the narrow but conspicuous pinkish brown tegminal margins distad.

Type.—♀; Muzo, Boyacá, Colombia. September, 1919. (From A. Maria.) [Hebard Collection, Type No. 1071.]

Size medium large and form robust for the genus. Fastigium elongate, gradually narrowing to the blunt, slightly decurved, apical tooth; dorsal surface with moderate channels present laterad in proximal portion, between which a moderate medio-longitudinal sulcus is indicated; ventral surface smooth beyond the three proximal nodes, with a medio-longitudinal carina which becomes more prominent distad. Face smooth and polished. Genae and pronotum polished, the former moderately and the latter very weakly rugulose. Infra-ocular carina provided with heavy granules, which are more conspicuous than in *C. cornuta* (DeGeer). Fastigium shorter and face broader than in that species; as described for *capito*. Tegmina and wings considerably reduced, unfit for flight; the former closely veined, extending beyond apex of abdomen. Ovipositor very elongate, but not above average length for the genus. Subgenital plate shallowly emarginate distad, with latero-caudal angles rounded and not embracing the ovipositor. Cephalic and median femora with ventro-cephalic margin alone armed with (5 to 6) spines, caudal femora with ventro-external margin alone armed with (11) still longer spines. Median tibiae with dorso-caudal margin alone armed with (3 and 4) small spines.

General coloration courge green, deeper and more olivaceous than that of *cornuta*. Facio-clypeal suture somewhat suffused with brown, clypeus and labrum buffy, internal portion of jaws black. Pronotum and costal margins of tegmina broadly tinged with brown, this probably due to discoloration. Tegmina immaculate, except humeral trunk which is buffy and distal margins which are narrowly vinaceous tawny, the latter marking, however, broader than in *C. cornuta denticornis* here described.

Length of body 45.4, length of fastigium (from apex of basal tooth to that of apical spine) 6, length of pronotum 10.7, length of tegmen 34.3, width of tegmen 9.8, length of caudal femur 20, length of ovipositor 45 mm.

Moncheca pretiosa Walker (Pl. XXII, figs. 13 and 14.)

1869. *Moncheca pretiosa* Walker, Cat. Dermapt. Saltat. British Mus., II, p. 289. [♀: Honduras; Oajaca, Mexico.]

1898. *E[xocephala] elegans* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIII, No. 311, p. 86. [♂; Valley of Santiago, Ecuador.]

The past literature on the species of this genus, usually referred to as *Exocephala* Serville,[47] is confusing and combined with the decided size difference between the sexes probably led, at least in part, to the synonym *elegans*. We also have material from southern Mexico; Guatel, Guatemala; Chanchamayo and the Piches and Perene Valleys, Peru, which is conspecific.

[47] Described in 1831, preoccupied by *Exocephala* Latreille, 1825, proposed for a genus of Molluscs.

Cauca, (F. Bonis), 10 ♀, [A. N. S. P.].

Loma Larga, northeastern slope of Sierra Nevada de Santa Marta, 2000 feet, July 28, 1920, (M. A. Carriker Jr.), 1 ♀.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, 4000 feet to 5000 feet, July, 1913, (M. A. Carriker Jr.), 1 ♀.

La Palmeta, Santander, 7500 feet, July 15 to 20, 1916, (M. A. Carriker Jr.), 1 ♀.

Rio Casenare, near Sacama, Boyacá, 1921, (Terry Dace), 1 ♀, [A. N. S. P.].

Cordillera del Rusio, Tolima, January, 1915, (from A. Maria), 1 ♀.

Susumuco, Cundinamarca, May, 1919, (A. Maria), 1 ♀.

Villavicencio, Intendencia del Meta, July and November, 1918, (from A. Maria), 1 ♂, 8 ♀.

The Andean material before us averages much darker than that from the Santa Marta region, the Cauca Valley and northward, but no differences of sufficient stability can be found to warrant even racial separation. The male sex is seen to be very much smaller than the female in this species.

This insect has been repeatedly confused with *M. bisulca* (Serville), though the general color pattern of these two species is very striking and different. Insufficient descriptions, combined with the belief that extreme color variations occurred, was probably the cause. One of the most important color characters for *pretiosa* is the ventral surface of the marginal half of the marginal field of the tegmina proximad, which is solidly rose red to carmine. This marking is very conspicuous, though, of course, concealed unless the tegmina are spread.

We do not believe that *pretiosa* will be found east of the eastern foothills of the Andes.

OCANA new genus

This genus is erected to include a single handsome species, *O. robusta* here described.

It is nearest *Moncheca* Walker, that genus being distinguished by the more slender form, narrower head, smooth infra-ocular area, fastigium with median production more slender and lateral productions less prominent, tri-sulcate pronotum, longer organs of flight, wings with transverse veins almost colorless, caudal femora with genicular lobes both spinose and richer coloration.

Nearer agreement with *Vestria* Stål is shown by *Ocana* only in the form of the fastigium, the subtuberculate infra-ocular region and general coloration, which is a duller and more glassy green than in *Moncheca*.

The following additional characters distinguish *Ocana*. Head smooth except for very low but large sub-tuberculations below the eyes (weaker than in *Lamniceps* Bolivar, another related genus), in place of an infra-ocular carina such as occurs in *Copiphora* Serville. Pronotum with three broad and deep transverse sulci and an additional broad but shallower sulcus across the deplanate metazona cephalad. Pronotal lateral lobes, tegminal venation and their broadly rounded apices, limb spination (except as noted above) and straight ovipositor as in *Moncheca*. Female subgenital plate deeply cleft.

Ocana robusta new species (Pl. XVIII, fig. 2; pl, XXI, fig. 15.)

The general appearance of this insect somewhat suggests the genus *Lamniceps* Bolivar, but its closest affinity is clearly to *Moncheca* Walker.

The beautifully colored transverse veins of the wings constitute a distinctive feature.

Type.— ♀ ; Pueblo Nuevo de Ocaña, Santander, Colombia. September 3, 1916. (M. A. Carriker Jr.) [Hebard Collection, Type No. 1072.]

In addition to the characters noted in the generic description, the following appear to have specific value. Size medium for this group of large species, form robust. Head and pronotum polished, the latter faintly impresso-punctulate. Fastigium about one and two-thirds as broad as the first antennal joint proximad, dorsal length about one and one-half times its width, apex bluntly rounded, projecting a short distance beyond the two large ventro-distal tubercles; dorsal surface convex with a row of small tubercles proximad on each side, the two proximal of which are decided; ventro-proximal tooth large and prominent. Face flattened, but rounding laterad much as in *Exocephala*. Prosternum unarmed, but showing two small tubercles; mesosternum coarsely bispinose; metasternal lobes rounded. Ovipositor elongate, straight, rather heavy proximad but tapering very gently and evenly to the acute apex. Subgenital plate small, apex weakly concave between two straight, slender, cylindrical, aciculate processes which are about two-thirds as long as the plate and lie along a strong medio-longitudinal keel there developed on the ventral surface of the ovipositor. Femora heavy; ventral femoral margins all armed with a number of small, stout spines. Genicular lobes of femora rounded, except internal of median and caudal femora which are produced in a small, stout spine.

General coloration light lumiere green, the tegmina decidedly glossy. Antennae light ochraceous tawny, the intersections of the joints finely chestnut brown proximad, such widely spaced distad. Face, mouthparts and mandibles dull zinc orange, the former with very large median ocellus buffy, the latter with apices blackish chestnut brown. Tegmina with thick network of veinlets of ventral surface of marginal field, excepting the green heavier transverse veinlets, pompeian red. Wings transparent, pale glaucous green; marginal field opaque, pompeian red; radiate veins deep lichen green, all transverse veinlets there pompeian red and also with decided lateral suffusions of this color at these veins in meso-cephalic portion. Limbs immaculate, except ventral surfaces, extreme apices of caudal tibiae, all tarsi and particularly the last two joints and ventral portion of external surface of cephalic tibiae, which are mummy brown. Ovipositor chamois, narrowly suffused with mummy brown along median intersection of the valves laterad except in proximal portion.

Length of body 27 (abdomen shrunken), width of fastigium (between disto-lateral tubercles) 1.4, length of pronotum 9, caudal width of pronotal disk 5.8, length of tegmen 41, greatest tegminal width 10, length of wing 39.3, greatest depth of wing 24, length of cephalic femur 9.3, length of caudal femur 18.4, length of ovipositor 24.7 mm.

VESTRIA Stål

We find *Vestria* to be a valid genus, distinguished from *Moncheca* Walker, under which (referred to as the preoccupied *Exocephala*) it has long been placed as a synonym, by the short recurved ovipositor, fastigium with median production heavier and lateral productions more prominent, infra-ocular region subtuberculate, weaker pronotal sulci and duller and more glassy green general coloration.

To it belong *repanda* (Walker), *viridis* (Redtenbacher), *parva* (Bolivar) and probably *punctata* (Redtenbacher). Under *repanda* we find *Basileus diadematus* Saussure and Pictet already correctly placed as a synonym and thus *Basileus* Saussure and Pictet falls as a synonym of *Vestria*.

The genotype, by monotypy, is *Vestria nigricauda* = *repanda* (Walker).

Karny supposed that the genus has the prosternum bispinose, due to the original description stating that it was armed on each side with a short spine. The prosternum is weakly bituberculate in our specimens and we believe is best termed unarmed.

Vestria repanda (Walker)

1869. *Locusta repanda* Walker, Cat. Dermapt. Saltat. British Mus., II, p. 284. [♀, locality unknown.]

1874. *V[estria] nigricauda* Stål, Recensio Orth., II, p. 105. [♀, locality unknown.]

Consideration of the original descriptions and a Guianan female before us, convinces of the above synonymy.

Villavicensio, Intendencia del Meta, 1921, (from A. Maria), 1 ♂.

This individual has the surface of the genae supplied with very low but large, irregular sub-tuberculations, such being scarcely appreciable in the Guianan female.

The previously unknown male agrees closely in size and ambisexual features with the female. The ultimate tergite is flattened with a strongly concave ridge and margin laterad, before each cercus; its caudal margin broadly concave between. The cerci are very large and very elongate, decurved, extending beyond and below the subgenital plate, flattened cylindrical, their apices suggesting spear-heads with external surface feebly concave and internal surface coarsely medio-longitudinally carinate. Subgenital plate ample, angulate emarginate distad, with very small, simple styles.

Length of body 32.7, width of fastigium (between disto-lateral tubercles) 1.8, length of pronotum 9.1, length of tegmen 52.8, width of tegmen 10.3, length of caudal femur 17 mm.

AGRAECIINAE

Agraecia pulchella new species (Pl. XX, figs. 15 and 16.)

This is a distinctive species, readily recognized by the striking markings of the pronotal disk and the green of the pronotal lateral lobes, tegminal veins and all but apices of the femora.

Nearest relationship is shown to the Colombian *A. vittata* Brunner, very poorly described from an immature female and consequently from the description, only separable by the very different pronotal marking.

Type.— ♀; Muzo, Boyacá, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1076.]

Size medium for the genus, form moderately robust. Head and pronotum smooth. Fastigium not projecting beyond proximal antennal joint when that is in an erect position, narrow and decidedly narrower than that joint, with apex bluntly rounded. First antennal joint not produced disto-internally. Pronotum with first sulcus moderately decided, the second distinct only on lateral lobes; metzona feebly produced, truncate; humeral sinus shallow. Tegmina and wings showing some reduction, extending only slightly beyond the short ovipositor. Prosternum bispinose. Mesosternal and metasternal lobes triangular with apices slightly produced. Ultimate tergite produced in a small, triangular projection meso-distad, the surface if which is concave, this concealing the supra-anal plate. Ovispositor bent dorsad meso-proximad as in *Nannagroecia gracilipes* Brunner, thence of subequal width to the acute apex. Subgenital plate deeply U-emarginate at apex, the lateral projections thus formed straight and aciculate. Ventral femoral margins armed with small stout spines as follows; cephalic internal 4, cephalic external 0, median internal 3, median external 4, caudal internal 4 and 4, caudal external 7 and 7. Genicular lobes of cephalic femora blunt, of median and caudal femora unispinose. Coloration of important diagnostic value.

Head, antennae and tibiae buckthorn brown, the former with occiput showing a faintly paler medio-longitudinal band and two of the same shade running caudad from the antennal sockets, these latter with borders slightly darker than the ground color. Pronotal disk ochraceous tawny, with lateral bands (continuations of the lateral occipital bands) of buffy which are margined with prouts brown externally and blackish chestnut brown internally; these bands gradually converge and then weakly diverge, making the area between them very narrowly hourglass shaped. Lateral lobes of pronotum light rich (vanderpoels) green, the finely cingulate cephalic, ventral, and caudal margins black. Coxae and pleura whitish with intersections black. Tegmina black with veins and very close network of veinlets calliste green (more olivaceous) to distal portions, where these become buckthorn brown. Wings faintly and evenly tinged with mummy brown; radiate veins black, other veins and veinlets blackish brown. Femora dull calliste green with apices buckthorn brown, ventral margins of cephalic and median femora suffused with blackish brown and cephalic and caudal femora with a proximo-external fleck of the same.

Length of body 22.2, length of pronotum 6.4, length of tegmen 24.5, greatest tegminal width 5.8, length of caudal femur 15.8, length of ovipositor 10, median width of ovipositor 1.7 mm.

The type of this handsomely colored species is unique.

CONOCEPHALINAE

Conocephalus cinereus (Thunberg)

1815. *C[onocephalus] cinereus* Thunberg, Mém. Acad. Imp. Sci. St. Pétersbourg, v, p. 273. [Jamaica.]

Boca Murindó, Intendencia del Chocó, February 9, 1918, (M. A. Carriker Jr.), 1 ♂, 1 ♀.

This species has also been recorded from Cali, Colombia.[48] It is known from the Bahamas and Vera Cruz, Mexico, to French Guiana and Peru.

Conocephalus angustifrons (Redtenbacher)

1891. *Xiphidium angustifrons* Redtenbacher, Monogr. der Conoceph., p. 524. [♂, ♀; Bogotá and Tolima, Colombia.]

El Tambo, Intendencia del Chocó, April 5, 1918, (M. A. Carriker Jr.), 1 ♀, (macropterous).

Andagoya, Antioquia, April 22, 1918, (M. A. Carriker Jr.), 2 ♂, 3 ♀, (brachypterous).

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, October, 1917, (M. A. Carriker Jr.), 4 ♂, 3 ♀, (all brachypterous, except 1 macropterous ♀).

The known distribution of this more richly colored species extends from Costa Rica to Colombia. In Colombia it is, however, apparently the most abundant and widely distributed species of the genus. It has also been recorded from the Hacienda Cincinnati on Sierra San Lorenzo and La Cumbre near Cali.[49]

Conocephalus saltator (Saussure)

1859. *X[iphidium] saltator* Saussure, Rev. et Mag. de Zool., (2), xi, p. 208. [♀, Guiana.]

Boca Murindó, Intendencia del Chocó, February 9, 1918, (M. A. Carriker Jr.), 1 ♂, (macropterous).

Cordoba, El Valle, May 23, 1918, (M. A. Carriker Jr.), 1 ♂, (macropterous).

This very common species is known from Nicaragua and Montserrat in the West Indies southward to Paraguay. It has been previously reported from Buenaventura and Cali, Colombia, by Rehn and Hebard.

[48] Rehn and Hebard, Trans. Amer. Ent. Soc., xli, p. 248, (1915).

[49] By Rehn and Hebard, Trans. Amer. Ent. Soc., xli, p. 260, (1915).

LISTROSCELINAE

Phlugis abnormis (Redtenbacher)

1891. *Thysdrus abnormis* Redtenbacher, Monogr. der Conoceph., p. 538, pl. 4, fig. 95. [♂, Retalulen (= Retahluleu, western Guatemala).]

Andagoya, Antioquia, April 22, 1918, (M. A. Carriker Jr.), 1 ♂, 4 ♀.

This is apparently not an abundant species, found northward from the above locality to Guatemala.

GRYLLACRINAE

Gryllacris carrikeri new species (Pl. XXI, figs. 16 and 17.)

This large and handsome insect is related to *G. salvini* Saussure and Pictet and *G. laevigata* Brunner, differing from the latter in the much more highly specialized male subgenital plate. This plate was damaged in the type of *salvini*, that species differing in the somewhat larger size, pale head and pink marking of pronotum and tegmina.[50] The similarity in the strikingly specialized male ultimate tergite best shows the close affinity of these three species.

Type.—♂; El Tambo, Intendencia del Chocó, Colombia. April 5, 1918. (M. A. Carriker Jr.) [Hebard Collection, Type No. 1073.]

Size and form medium for the genus, large for the American species. Fastigium nearly twice width of proximal antennal joint, smooth, rounding laterad; confluent with facial fastigium, their juncture indicated only by a feebly impressed area on each side. Surface of head smooth and shining. Pronotum with cephalic margin of disk very weakly angulato-convex; cephalic and principal sulci subobsolete on disk, coarse and deep on lateral lobes and there confluent ventrad; longitudinal sulcus represented by a fine, impressed line mesad and subobsolete caudad; lateral lobes longer than deep, ventro-cephalic angle broadly rounded obtuse-angulate, ventral margin straight and slightly declivent to meso-caudal point, thence straight and slightly more strongly ascendant to the sharply rounded obtuse-angulate ventro-caudal angle; humeral sinus forming a very broad concavity. Tegmina and wings fully developed, very elongate, extending far beyond apex of abdomen. Ultimate tergite broad and narrow, rounding caudad, mesad with deep rounded-rec-

[50] Discoloration may, however, have occurred in the type of *carrikeri*, resulting in the destruction of this delicate pink tint.

tangulate emargination, the sides formed by two lateral arms which are directed ventro-mesad, their apices armed with a stout tooth and separated from each other by slightly more than the width of the slender produced portion of the subgenital plate. Cerci slender, cylindrical, tapering, weakly recurved. Socketed styles very slender throughout, weakly recurved, slightly shorter than cerci, extending as far caudad with distal portion very similar in appearance. Subgenital plate with a small, cylindrical process on each side, erect and recurved, springing from above base of each style, its acute apex reaching the cercus; mesad produced dorsad in a very elongate slender finger which curves broadly cephalad, its apex well above caudal margin of ultimate tergite; this process cleft to base, the ventral surface convex in proximal half, thence faintly widening as two adjacent convex portions so that it appears medio-lontitudinally sulcate, while distad these adjacent portions become very slender, their adjacent, minute apices slightly enlarged and each supplied with numerous small spines. Ventral margins of caudal femora alone armed with (6 and 7) external and (9 and 10) internal spines, the internal series being very short proximad but becoming very long distad. Ventral margins of cephalic and median tibiae armed with four pairs of spines, but unarmed at apices. Caudal tibiae armed dorsad with (3 and 5) external and (5 and 5) internal spines.

Like in the allied *cruenta* Brunner, the female of *carrikeri* will probably be found to have a very elongate ovipositor, curving feebly dorsad to a bluntly rounded apex.

General coloration light cinnamon buff (with no trace of pink, due possibly to discoloration). Head shining; occiput, vertex and face to near clypeal suture blackish brown, this fading into the paler general coloration back of the eyes and below, a triangular outline of buffy on occiput. Antennae immaculate, except for a faint suffusion of brown on the first joint. Pronotum showing very faint suffusions of brown, particularly dorso-laterad. Tegmina and wings transparent, faintly tinged with buff, the veins cinnamon buff; the tegmina rather thickly supplied with microscopic hairs distad. Spines of caudal femora only in distal half brown. Minutely spined apex of subgenital plate brown.

Length of body 22, least width of fastigium 1.2, length of pronotum 5.1, length of tegmen 39.5, length of cephalic femur 7.9, length of longest cephalic tibial spine 1.2, length of caudal femur 13.9, length of production of subgenital plate 6.3 mm.

This male type is unique.

EXPLANATION OF PLATES

Plate XVIII

Fig. 1.—*Quiva diaphana* new species. Dorsal view of male. Aguadita, Cundinamarca, Colombia. *Type.*

Fig. 2.—*Ocana robusta* new species. Dorsal view of female. Pueblo Nuevo de Ocaña, Santander, Colombia. *Type.*

Plate XIX

Fig. 1.—*Euceraia insignis* new species. Lateral view of female. Pueblo Nuevo de Ocaña, Santander, Colombia. *Type.* (Natural size.)

Fig. 2.—*Euceraia insignis* new species. Caudal view of apex of male abdomen, showing the cerci and cerciform appendages above them. Eden, Nicaragua. *Allotype.* (Much enlarged.)

Fig. 3.—*Euceraia insignis* new species. Lateral view of male cercus. Eden, Nicaragua. *Allotype.* (Much enlarged.)

Fig. 4.—*Euceraia insignis* new species. Ventral view of male subgenital plate. Eden, Nicaragua. *Allotype.* (Much enlarged.)

Fig. 5.—*Stilpnochlora corrugata* new species. Dorsal view of male pronotum. Cundinamarca, Colombia. *Type.* (× 2)

Fig. 6.—*Stilpnochlora corrugata* new species. Lateral view of male tegmen. Cundinamarca, Colombia. *Type.* (Natural size.)

Fig. 7.—*Peucestoides stridulans* new species. Lateral view of male median tibia to show expansion and coloration. Orocué, Intendencia del Meta, Colombia. *Type.* (× 2)

Fig. 8.—*Anaulacomera asema* new species. Lateral outline of male cercus. Choachi, Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 9.—*Anaulacomera asema* new species. Ventral view of apex of male subgenital plate. Choachi, Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 10.—*Anaulacomera gibbera* new species. Lateral view of male pronotum. Cundinamarca, Colombia. *Type.* (Much enlarged.)

Fig. 11.—*Anaulacomera gibbera* new species. Lateral outline of male cercus. Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 12.—*Anaulacomera gibbera* new species. Lateral outline of ovipositor. Cundinamarca, Colombia. *Allotype.* (× 4)

Fig. 13.—*Anaulacomera phaula* new species. Lateral outline of male cercus. Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 14.—*Anaulacomera phaula* new species. Ventral view of apex of male subgenital plate. Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 15.—*Anaulacomera hirsuta* new species. Lateral view of male cercus. Susumuco, Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 16.—*Anaulacomera hirsuta* new species. Lateral outline of proximal arm of male cercus. Susumuco, Cundinamarca, Colombia. *Type.* (Enlargement greater than in Fig. 15.)

Plate XX

Fig. 1.—*Quiva diaphana* new species. Ventral view of male subgenital plate. Aguadita, Cundinamarca, Colombia. *Type.* (Much enlarged.)

Fig. 2.—*Quiva diaphana* new species. Dorsal outline of male cercus. Aguadita, Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 3.—*Anaulacomera caucana* new species. Lateral view of male cercus, (note that in this position only the base of the large arm is visible, while the internal spike of the distal portion is entirely concealed). Cauca, Colombia. *Type.* (Greatly enlarged.)

Fig. 4.—*Anaulacomera caucana* new species. Caudal view of male cercus, (note that the proximal portion of the shaft is decidedly foreshortened in this aspect). Cauca, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 5.—*Anaulacomera caucana* new species. Lateral outline of arm of male cercus. Cauca, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 6.—*Anaulacomera caucana* new species. Dorsal view of produced portion of male ultimate tergite. Cauca, Colombia. *Type.* (Greatly enlarged.)

Fig. 7.—*Anaulacomera apolinari* new species. Lateral view of male cercus, (note that the transverse spatulation and armament of the distal portion as well as the internal arm and spike of the shaft can not be seen in this aspect). Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 8.—*Anaulacomera apolinari* new species. Ventral view of male cercus, (note that the erect, transversely spatulate distal portion of the cercus is very greatly foreshortened in this aspect). Cundinamarca, Colombia. *Type.* (Same scale as Fig. 7.)

Fig. 9.—*Anaulacomera apolinari* new species. Caudal view of male cercus, (note that only the transverse spatulation and armament of the distal portion can be plainly seen in this aspect, the proximal portion of the shaft being greatly foreshortened and its internal processes almost wholly concealed). Cundinamarca, Colombia. *Type.* (Same scale as Fig. 7.)

Fig. 10.—*Anaulacomera apolinari* new species. Dorsal view of produced portion of male ultimate tergite. Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 11.—*Viadana boyacae* new species. Dorsal outline of male tegmen, showing principal venation. Muzo, Boyacá, Colombia. *Type.* (× 1½)

Fig. 12.—*Viadana boyacae* new species. Dorsal outline of male ultimate tergite, showing also base of supra-anal plate. Muzo, Boyacá, Colombia. *Type.* (Greatly enlarged.)

Fig. 13.—*Viadana boyacae* new species. Lateral outline of male cercus. Muzo, Boyacá, Colombia. *Type.* (Greatly enlarged.)

Fig. 14.—*Itarissa costaricensis gracilior* new subspecies. Dorsal outline of male tegmen, showing principal veins and markings. Muzo, Boyacá, Colombia. *Type.* (× 1½)

Fig. 15.—*Agraecia pulchella* new species. Dorsal view of female pronotum. Muzo, Boyacá, Colombia. *Type.* (× 2½)

Fig. 16.—*Agraecia pulchella* new species. Lateral outline of ovipositor and subgenital plate. Muzo, Boyacá, Colombia. *Type.* (× 2½)

Plate XXI

Fig. 1.—*Itarissa subcrenulata* new species. Dorsal outline of male tegmen, showing principal veins. Villavicencio, Intendencia del Meta, Colombia. *Type.* (Natural size.)

Fig. 2.—*Bliastes annulipes* new species. Dorsal outline of male cercus. Fusagasugá, Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 3.—*Bliastes annulipes* new species. Lateral outline of male cercus. Fusagasugá, Cundinamarca, Colombia. *Type.* (Same scale as Fig. 2.)

Fig. 4.—*Chibchella personata* new species. Lateral view of ovipositor. Cundinamarca, Colombia. *Type.* (× 1½)

Fig. 5.—*Brachyauchenus magdalenae* new species. Ventral view of distal portion of male subgenital plate and styles. Hacienda Vista Nieve, Magdalena, Colombia. *Type.* (Greatly enlarged.)

Fig. 6.—*Brachyauchenus magdalenae* new species. Lateral view of ovipositor. Hacienda Vista Nieve, Magdalena, Colombia. *Paratype.* (× 1½)

Fig. 7.—*Brachyauchenus difficilis* new species. Ventral view of male subgenital plate and styles. Cauca, Colombia. *Type.* (Greatly enlarged.)

Fig. 8.—*Brachyauchenus difficilis* new species. Lateral view of ovipositor. Cauca, Colombia. *Allotype.* (× 1½)

Fig. 9.—*Cocconotus carmelitae* new species. Outline of distal portion of male subgenital plate and styles. Hacienda Vista Nieve, Magdalena, Colombia. *Type.* (Greatly enlarged.)

Fig. 10.—*Cocconotus carmelitae* new species. Lateral view of ovipositor. Hacienda Vista Nieve, Magdalena, Colombia. *Allotype.* (× 1½)

Fig. 11.—*Cocconotus apolinari* new species. Lateral view of ovipositor. Villavicencio, Intendencia del Meta, Colombia. *Type.* (× 1½)

Fig. 12.—*Caulopsis microprora* new species. Dorsal outline of distal portion of male head. Aracataca, Magdalena, Colombia. *Type.* (× 5)

Fig. 13.—*Copiphora cornuta denticornis* new subspecies. Lateral outline of distal portion of female head. Susumuco, Cundinamarca, Colombia. *Type.* (× 3)

Fig. 14.—*Copiphora colombiae* new species. Cephalic view of female head. Muzo, Boyacá, Colombia. *Type.* (× 1½)

Fig. 15.—*Ocana robusta* new species. Cephalic view of female head. Pueblo Nuevo de Ocaña, Santander, Colombia. *Type.* (× 1½).

Fig. 16.—*Gryllacris carrikeri* new species. Caudal view of male abdomen. El Tambo, Intendencia del Chocó, Colombia. *Type.* (× 2)

Fig. 17.—*Gryllacris carrikeri* new species. Lateral view of distal portion of male abdomen. El Tambo, Intendencia del Chocó, Colombia. *Type.* (× 2)

Plate XXII

Fig. 1.—*Quiva diaphana* new species. Cephalic view of male head. Aguadita, Cundinamarca, Colombia. *Type.* (Much enlarged.)

Fig. 2.—*Ceraia tibialis* Brunner. Dorsal view of male ultimate tergite. Susumuco, Cundinamarca, Colombia. (Much enlarged.)

Fig. 3.—*Ceraia tibialis* Brunner. Lateral view of distal portion of male abdomen. Susumuco, Cundinamarca, Colombia. (Much enlarged.)

Fig. 4.—*Ceraia tibialis* Brunner. Ventral view of apex of male subgenital plate. Susumuco, Cundinamarca, Colombia. (Much enlarged)

Fig. 5.—*Anaulacomera invisa* new species. Dorsal outline of male cercus. Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 6.—*Eucocconotus annulatus* new species. Lateral view of female. Medellin, Antioquia, Colombia. *Type.* (Natural size.)

Fig. 7.—*Eucocconotus annulatus* new species. Dorsal view of female fastigium. Medellin, Antioquia, Colombia. *Type.* (Greatly enlarged.)

Fig. 8.—*Rhodopteryx elongata* Vignon. Dorsal view of male. Muzo, Boyacá, Colombia. (Natural size.)

Fig. 9.—*Rhodopteryx elongata* Vignon. Cephalic face of male cephalic femur. Muzo, Boyacá, Colombia. (× 1¾)

Fig. 10.—*Rhodopteryx elongata* Vignon. Cephalic face of male median femur and tibia. Muzo, Boyacá, Colombia. (× 1¾)

Fig. 11.—*Rhodopteryx elongata* Vignon. External face of male caudal femur and tibia. Muzo, Boyacá, Colombia. (× 1¾)

Fig. 12.—*Neoconocephalus brachypterus* (Redtenbacher). Lateral outline of female. Cunday, Tolima, Colombia. (Natural size.)

Fig. 13.—*Moncheca pretiosa* Walker. Lateral view of female. Cordillera del Rusio, Tolima, Colombia. (Natural size.)

Fig. 14.—*Moncheca pretiosa* Walker. Dorsal outline of female fastigium. Cordillera del Rusio, Tolima, Colombia. (Much enlarged.)

Fig. 15.—*Peucestoides stridulans* new species. Dorsal view of male head, pronotum and stridulating area of tegmina. Orocué, Intendencia del Meta, Colombia. *Type.* (Natural size.)

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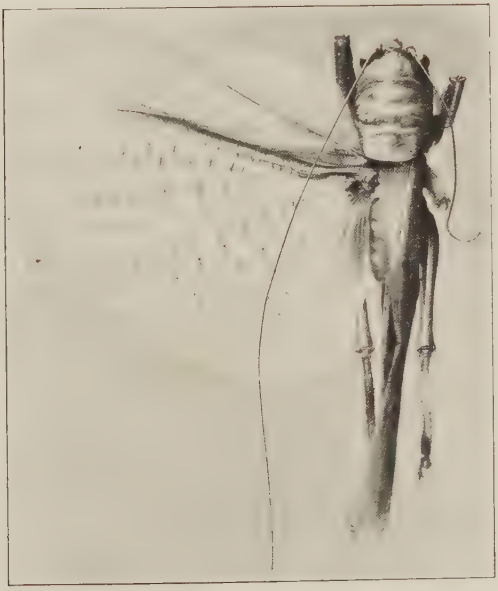

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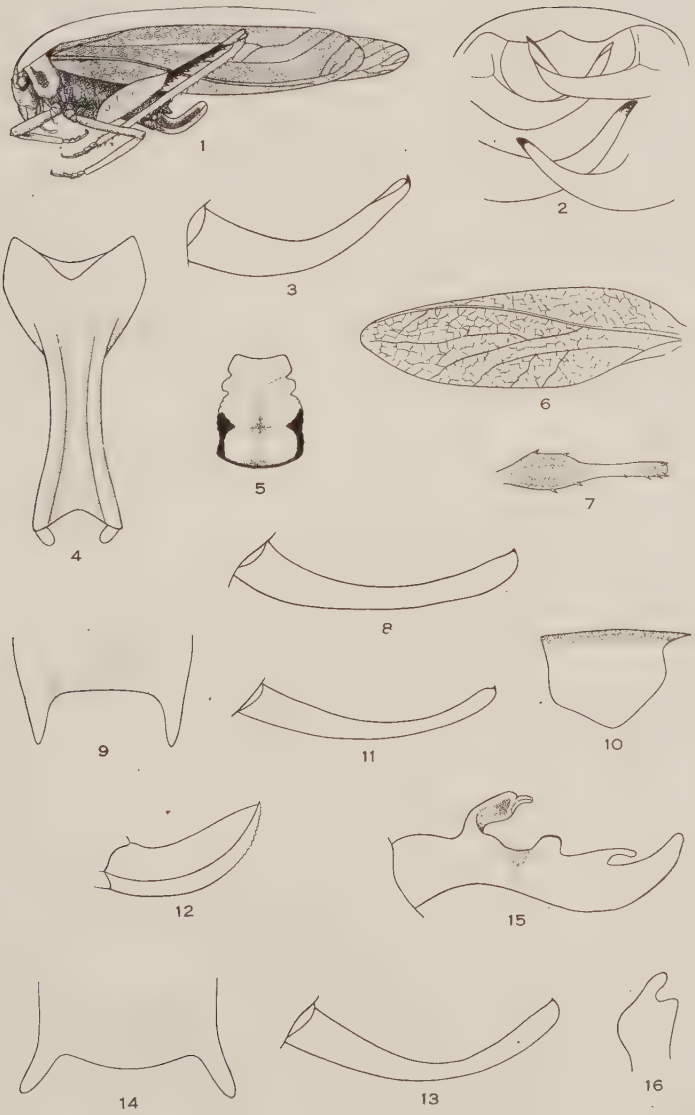
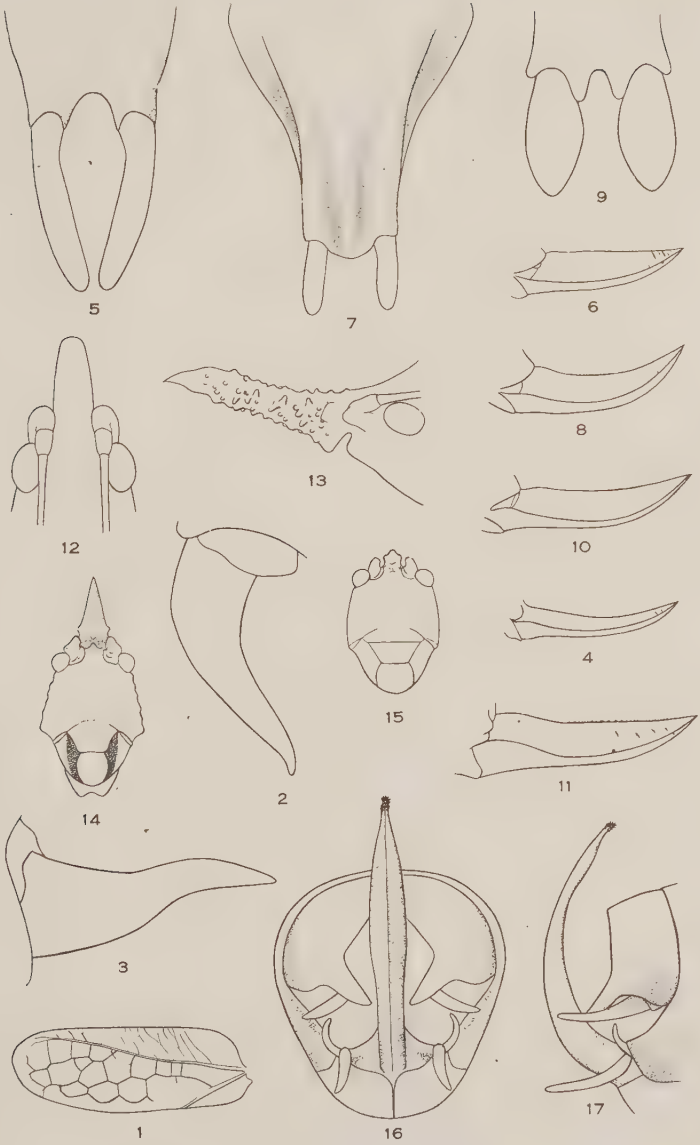


HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA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VARIATIONS IN SIZE OF CALOPTERYX MACULATA AND A PROPOSED NEW SUBSPECIES, (ODONATA; AGRIONIDAE)

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The variations in size of animals of a given species distributed over a considerable area has long been of interest. Extensive measurements of the skulls of several species of mammals led J. A. Allen, in "Geographical Variation among North American Mammals, especially in respect to Size," [1] to say: "The generally received impression that in North America, species of mammalia diminish in size southward requires modification. While such is generally the case, the reverse of this too often occurs, with occasional instances also of a total absence of variation in size with locality." As to insects, the general impression has been that members of a species will be found to increase in size southward. Certain widely distributed insects are favorable to such a study in order to demonstrate quantitatively the truth or falsity of this general opinion that such an increase in size does occur.

Scudder, in "Butterflies of the Eastern U. S. and Canada" mentions several species that have a range from Canada to Florida, but does not usually take up the matter of differences in size. However, on page 1288 in the case of *Papilio turnus* he reports that specimens from Alaska are slightly smaller than those from the White Mountains, New Hampshire, which in turn are generally smaller than those of other parts of New England, and that those of Newfoundland are smaller than Continental specimens.

Rehn and Hebard, in "A Revision of the Species of the genus Atlanticus." [2] report that in *Atlanticus testaceus*, a species extending from Vermont to Florida, geographical variations do not

[1] Bulletin U. S. Geological and Geographical Survey of the Territories, Vol. II, p. 309, 1876.

[2] Trans. A. E. S., XLII, p. 42.

appear, excepting that the females show increase southward in size of pronotum, which increase to a degree is correlated with variations in general size. In connection with *Atlanticus americanus*, page 76, there is a range in average body length and length of femur, as follows:

		Body Length	Caudal Femur
Staten Island, N. Y.	♂	20	22.9
	♀	20 -	25
Greensboro, N. C.	♂	30.7	25.5
	♀	29	29.4
River Junction, Fla.	♂	25.7	27.8
	♀	28.4	32.2

In "A Synopsis of the Species of the Genus Orchelimum," [3] they report the following increase for *Orchelimum glaberrimum*, in average size southward, yet not invariably, for there is considerable variation. Local factors seem to influence size.

		Body Length	Caudal Femur
Lakehurst, N. J.	♂	20.2	17.3
	♀	22.5	18
Fayetteville, N. C.	♂	25	19.8
	♀	23.2	20.5
Florence, S. C.	♂	25.5	20
	♀	24.7	21
So. Jacksonville, Fla.	♂	24	23.3
	♀	23.2	22

E. M. Walker, in "The North American Dragon Flies of the Genus Aeshna" reports, page 25, for *Aeshna eremita* that specimens from different localities vary in size chiefly as to the female abdominal appendages and the length of the third abdominal segment, those from Toronto, in Southern Ontario being largest, those from Hayden, in Northern Ontario, intermediate, and those from Bay of Islands, Newfoundland, smaller.

Calopteryx maculata, a species of Odonata, was thought to be favorable for the study of geographical variations in size. The specimens available were collected over a wide range of territory, from southern Maine and southern Ontario in the north to a

[3] Trans. A. E. S. XLI, p. 35.

point well down in the Florida Peninsula, and from the Atlantic Coast to Iowa and Texas. There is little information available as to the natural limits of this species, although Dr. Philip P. Calvert says that it has not been noted in Cuba or Mexico. Hagen, in Psyche,[4] "Synopsis of the Odonata of North America No. 1," gives Quebec as the northern limit. However, the range is sufficiently wide, both in distance and in differences of temperature to make the study profitable.

The species has been described by Hagen, in volume five of Psyche, and at greater length and more recently by P. Garman, in "The Zygoptera, or Damsel-Flies, of Illinois."[5] under the name of *Agrion maculatum*.

The insects are found apparently throughout the summer along small streams running through shady wooded districts. The specimens examined were about one hundred and seventy-five in number from about thirty-five different localities, and from a few to twenty or more from a given locality. In but few cases, those from the same locality were not gathered during the same season, which may or may not have been an advantage.

The following is a list of the names of those who kindly loaned their collections for study, with the localities from which the material came:

C. S. Brimley, Division of Entomology, Raleigh, N. C..... North Carolina.

Academy of Natural Sciences of Philadelphia, Pa..... Manchester, Maine.

P. P. Calvert, University of Pennsylvania, Philadelphia. Vicinity of Philadelphia. Franklin County, Pa. Gunntown, Florida.

E. B. Williamson, Bluffton, Indiana..... Ontario. Western Pennsylvania. Ohio. Iowa. Indiana. Washington, D. C. Beltsville, Maryland. North Carolina. Tennessee, Florida.

U. S. National Museum, Washington, D. C..... West Virginia. South Carolina. Florida. Alabama. Texas.

[4] Vol. V, 1890, p. 249.

[5] Bulletin of the Illinois State Lab. of Natural History, 1917, p. 469.

All the individuals were adults.

The measurements made were: (a) body length, not including abdominal appendages; (b) abdominal length, not including appendages; (c) caudal femur; (d) caudal tibia; (e) fore wings; (f) hind wings. Except in a few instances, where mutilations made it impossible, all the measurements were made on the right side. A small, simple dissecting microscope with lens 12 × was used, and measurements carefully made to one-half millimeter.

There is considerable variation as to size in all parts of the body among individuals of both sexes taken in the same locality. The Maine specimens, for instance, were taken at Manchester over a period of several years, and varied in total length from 39 to 44 mm.; the femora from 6.5 to 7 mm.; the fore wings from 28 to 32 mm.; and the hind wings from 27 to 31 mm.; about 12.5% in each case. The specimens from Charmian, Franklin County, Pennsylvania were all taken on the same day. Variations were: body length, 43 to 46.5 mm. and fore wings 28 to 31.5 mm. or about 8%. Thus there seems to be considerable variation both among specimens of a given locality taken at the same time and among specimens taken in a number of different seasons.

The variations among male specimens measured, range from an individual from Ontario of 38 mm. to one of 55 mm. from Florida, as to body length; an individual of 6.5 mm. from Maine to one of 8.5 mm. from Florida as to femur; an individual of 27.5 mm. from Philadelphia to one of 36 mm. from Florida, as to length of fore wings. Females show substantially the same variations.

The following Table I is an exhibition of the averages of the measurements of the various parts for the males and for the females in each group. Where localities are quite close together, or in a State in which the normal temperatures and altitudes do not vary greatly, as in Indiana, or Iowa, several groups are combined.

TABLE I

Place		Body Length	Abdomen Length	Caudal Femur	Caudal Tibia	Fore Wing	Hind Wing
Manchester, Maine	13♂	42.0	33.0	6.7	8.0	29.7	28.7
	9♀	42.8	33.7	6.0	8.2	32.0	31.1
Lake Sinicoe, Searchmont & Ste. St. Marie, Ontario	7♂	43.2	34.0	7.1	7.9	31.5	30.4
	6♀	44.2	34.4	7.2	8.4	33.2	32.4
Mahoning, Ohio	2♂	43.8	34.8	7.3	7.8	30.3	29.0
Philadelphia, Pa.	6♂	44.0	35.1	6.6	7.6	28.1	27.1
	7♀	42.1	33.5	7.1	8.0	30.7	29.6
Beltsville, Md.	4♂	44.0	35.3	7.1	7.9	28.5	27.9
	4♀	43.8	35.1	7.3	8.0	30.6	29.8
Waterloo, Decorah & Des Moines, Iowa.	5♂	44.1	35.1	7.0	7.9	28.9	27.9
	7♀	45.4	36.1	7.2	8.4	32.1	31.1
Charmian, Pa.	8♂	44.4	35.3	7.0	8.1	29.8	28.8
	6♀	43.3	34.4	7.1	8.1	31.2	30.3
Raleigh & So. Pines, No. Carolina	6♂	44.4	35.8	6.7	7.9	28.9	28.0
	2♀	44.7	35.7	7.7	8.8	32.0	31.3
Rockwood, Pa.	1♂	45.0	36.0	7.0	8.0	30.0	28.5
Longview & Auburn, Alabama	2♂	45.0	35.8	8.0	8.8	29.5	28.5
Cranesville, West Virginia	2♂	45.3	36.0	8.3	8.8	28.5	27.8
Cincinnati, Ohio	1♂	45.5	36.5	7.5	8.0	31.0	30.5
	3♀	46.5	36.5	8.3	9.1	33.8	33.0
Indiana	14♂	45.9	36.1	7.4	8.3	30.3	29.3
	10♀	45.6	36.2	7.5	8.5	33.0	32.0
Mineola, Texas	4♂	45.9	36.8	7.5	7.8	27.9	27.0
Pittsburgh, Pa.	1♂	46.0	36.5	7.5	8.5	30.5	29.5
	1♀	44.0	35.0	8.0	8.5	32.5	32.0
Nashville, Manchester & Sycamore, Tennessee.	3♂	46.5	37.0	7.4	8.5	30.0	29.5
	1♀	46.0	36.0	8.0	9.0	33.0	32.0
Charleston, S. C.	1♂	50.0	40.5	—	—	33.0	32.0
Denison, Texas	1♂	52.0	43.0	8.5	9.0	32.0	31.0
Enterprise, Fla.	13♂	51.2	41.5	8.3	9.0	32.9	31.9
	2♀	51.3	41.3	8.3	9.0	36.0	35.0
Gunntown, Fla.	9♂	53.4	43.0	8.1	9.2	34.8	33.9
	7♀	53.5	43.4	8.1	9.4	37.4	36.4
New Smyrna, Fla.	3♂	55.0	45.2	9.0	9.7	35.6	34.5

Size. The data of the foregoing Table I show that the females are larger, but only slightly larger than the males. This su-

periority in size is found in all the groups where both sexes are represented as to femur, tibia and length of wing. For body length and abdominal length, the averages of the male are larger in a few instances, namely those from Indiana, Philadelphia, Charmian, Pennsylvania and Beltsville, Maryland; Tennessee and Enterprise, Florida, have respectively but one and two females, therefore, they can be disregarded. In all the other groups, the body length and abdominal length of the females are larger. Hagen gives the size of the females which he examined as 32 to 50 mm. and the males 44 to 48 mm., thus there is a general agreement as to size between his measurements and mine. Garman, however, gives somewhat different measurements, the length of females being 41 mm. and males 46 mm., the length of the wings of the female 30 and the male 29.

EXPLANATION OF GRAPHS

The Graphs are of the measurements of the body lengths, hind wing lengths and caudal femur lengths of 76 male of *Calopteryx maculata* and 27 male of *Calopteryx maculata floridana.*

Ordinates = Numbers of specimens measured.

Abscissae = Lengths in millimeters.

Where the curves of the two groups overlapped, not more than one individual of each group overlapped the curve of the other group. In other features measured the overlapping individuals were normal. For example: specimen No. 75, from Sycamore, Tennessee, unusually long in body length was 31 mm. in hind wing length, and 7.5 mm. in caudal femur length; specimen No. 158 from Enterprise, Florida, was short as to wing length, 30 mm., but normal in body length, 51 mm., and in femur length, 8.5 mm.; specimen No. 86 from Searchmont, Ontario, having an unusual hind wing length of 34 mm. was very short as to body length, 38 mm.

Table II, which follows is an exhibition of the order into which the average measurements of male specimens from various localities fall as to body length, femora and fore wings from shortest to longest.

TABLE II

Body Length	Femur Length	Fore Wing Length
Maine	Philadelphia	Texas
Ontario	Maine	Philadelphia
Philadelphia	North Carolina	Beltsville, Md.
Beltsville, Md.	Iowa	Iowa
Iowa	Charmian, Pa.	North Carolina

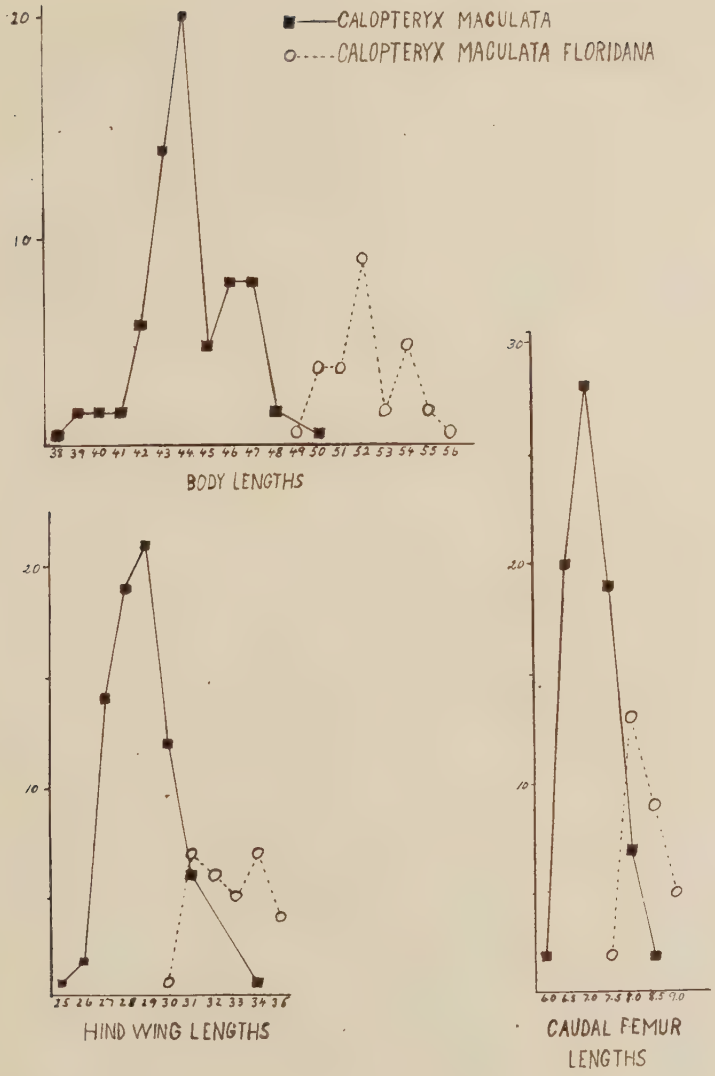
CALOPTERYX MACULATA
CALOPTERYX MACULATA FLORIDANA
20
10
38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
BODY LENGTHS
20
10
25 26 27 28 29 30 31 32 33 34 36
HIND WING LENGTHS
30
20
10
6.0 6.5 7.0 7.5 8.0 8.5 9.0
CAUDAL FEMUR LENGTHS

TABLE II—*Continued*

Body Length	Femur Length	Fore Wing Length
Charmian, Pa.	Ontario	Maine
North Carolina	Beltsville, Md.	Charmian, Pa.
Indiana	Indiana	Tennessee
Mineola, Texas	Tennessee	Indiana
Tennessee	Texas	Ontario
Enterprise, Fla.	Gunntown, Fla.	Enterprise, Fla.
Gunntown, Fla.	Enterprise, Fla.	Gunntown, Fla.
New Smyrna, Fla.	New Smyrna, Fla.	New Smyrna, Fla.

Table III contains the annual mean temperatures and annual normal precipitations of the localities from which specimens came or places near them as given in "The Climatology of the United States," by A. J. Henry.[6]

TABLE III

Place	Annual Mean Temperature	Normal Precipitation
Ontario	40	32.4 Inches
Maine	42	42.8 "
Iowa	49	32.4 "
Indiana	52.3	38.4 "
Pittsburgh, Pa.	53	36 "
Philadelphia, Pa.	54	40 "
Cincinnati, Ohio	55	38.4 "
Beltsville, Md.	55	43.1 "
Tennessee	59	48.6 "
North Carolina	60	49.9 "
Enterprise, Fla.	72	49.6 "
Gunntown, Fla.	69	54.9 "
New Smyrna, Fla.	70	51.1 "

All investigators seem to agree that the climatic elements of greatest importance in the development of animals so far as they are known are temperature and precipitation, and the temperature is the single element that has most influence. Certainly, the specimens taken in a given locality, while varying greatly for a given part of the body, tend to have a point around which they center. Thus if we consider body length, of the thirteen specimens from Ontario, nine were between 43 and 45 mm.; of 24 from Indiana, 13 were 46 to 47; of 12 from Iowa, 7 were 44 to 44.5.

[6] 1906, Bulletin Q, U. S. Weather Bureau.

A study of the effects of temperature show that temperature is not dependent upon latitude. Reference to the map in C. H. Merriam's, "Life Zones and Crop Zones," [7] will show Life Zones based on the accumulated temperatures for growing seasons. All our specimens, except those from Ontario, Maine and Florida are from the Upper Austral Zone, or the Transition Zone close to the Upper Austral Zone. Yet there seems to be no definite correlation, because for body length in Table II, we have one arrangement of localities, while for femur length and wing length quite a different arrangement. Specimens from Raleigh and Southern Pines, on the border between the Upper and Lower Austral Zones are not largest in most of the body parts measured. However, where there is a great difference in mean temperature as between the highest of the Upper Austral Zone (North Carolina 59 degrees) and Florida (70 degrees), we find such an increase in size of all parts that the Florida specimens stand distinctly by themselves.

Adult insects do not change in size. The explanation for variations among individuals from the same locality and in averages of individuals from different localities must be sought in factors influencing the earlier instars. In most of the localities under study there are periods varying from a short time to over four months, when the streams in which the larvae live are frozen over and the larvae inactive. Yet only in a general way for body and abdominal length does there seem to be any general correlation with the length of these inactive periods.

The mean temperatures neither for the year nor for the part of the year the larvae or adults are active seem to explain why for body length specimens from Iowa should be longer than those from Maryland; nor for femur length why those from Ontario (7.1 mm.) should be longer than those from Philadelphia (6.6 mm.). The lengths of wings for the different geographical groups vary still more.

It may be that temperature and precipitation where these influences act the whole year, as in Florida, have a definite effect on the development of all parts of the insect. Another possible explanation may be the one offered by J. A. Allen in his paper

[7] Biological Survey, U. S. Dept. of Agriculture, 1898.

on Geographical Variation among Mammalia, that a species is largest in those localities where the conditions of environment are most favorable to the life of the species.

There is always the possibility that with larger collections from the localities studied the averages of measurements may materially change; but the number measured seemed great enough to demonstrate that the Florida specimens are distinctly larger than those from other parts of the Country. This superiority in size holds good for all of the parts measured. In a very few instances specimens from places other than in Florida, in one feature approach in size the smaller individuals of the Florida group, but only in that feature, for in other respects they are distinctly smaller. The fact that the specimens divide so clearly into these two groups leads one to think that those in and near Florida constitute a subspecies. It is unfortunate that we could not procure more than one specimen from Charleston, South Carolina, and from Denison, Texas, as both of these are within the limits of the size of the Florida group and a larger number from those places might show a wider distribution of the subspecies.

In several papers, C. H. Kennedy points out the divergent characters shown in the penes of closely related species of Odonata. The penis of a specimen from Florida was compared with that of one from Charmian, Pennsylvania, but no apparent change in form could be distinguished.

Should the contention hold good that the individuals of *Calopteryx maculata* in and near Florida constitute a subspecies, I propose as a name:

Calopteryx maculata floridana new subspecies

Type; male (abdomen 47 mm., hind wing 35 mm.) from Gunntown, Levy County, Florida, taken by Mr. Philip Laurent, April 1–6, 1922. It will be deposited in the collection of the Academy of Natural Sciences of Philadelphia.

I am greatly indebted to those who loaned their collections and especially to Professor Calvert, who suggested the problem and frequently advised in the work.

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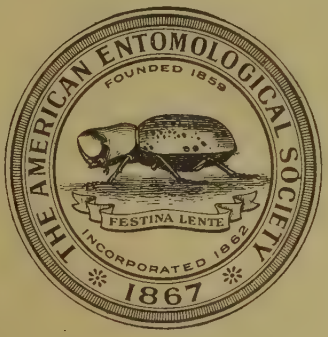

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CONTENTS

Our Largest Psychid, Oiketicus dendrokomos (Lepidoptera, Psychidae). By Frank Morton Jones 1
(Issued April 14, 1926)

Notes on Muscoid Flies with Retraced Hind Crossvein, with Key and Several New Genera and Species. By J. M. Aldrich 7
(Issued April 14, 1926)

On the Habits and Development of a Checkered Beetle (Cymatodera undulata Say). By W. V. Balduf . . 29
(Issued April 14, 1926)

A New Dolichopodid Genus with Descriptions of Five New Species (Diptera). By M. C. Van Duzee 39
(Issued April 14, 1926)

VOLUME LII NUMBER 2

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CONTENTS

A Key to the North American Genera of the Acridinae which Occur North of Mexico (Orthoptera, Acrididae). By Morgan Hebard 47
(Issued, May 12, 1926)

Studies in the Neotropical Hesperioidea (Lepidoptera). By Roswell C. Williams, Jr. 61
(Issued, May 12, 1926

Three New Species of Cicadellidae Previously Confused with Related Species. The Genus Lonatura (Homoptera). By D. M. DeLong 89
(Issued, June 1, 1926)

New Genera and Species of Membracidae (Homoptera). By Frederic W. Goding 103
(Issued, June 1, 1926)

New Species of Megachile, with Notes and Corrections (Hymenoptera, Megachilidae). By Theodore B. Mitchell. 111
(Issued, June 20, 1926)

New American Thysanoptera. By Dudley Moulton . . 119
(Issued, July 22, 1926)

Descriptions and Records of North American Bremidae, Together with Notes on the Synonymy of Certain Species (Hymenoptera). By Theodore F. Frison. . 129
(Issued, July 30, 1926)

VOLUME LII NUMBER 3

SEPTEMBER, 1926

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CONTENTS

Studies in the Dermaptera and Orthoptera of Colombia. Fourth Paper. Orthopterous Family Tettigoniidae. By Morgan Hebard 275

(Issued, January 14, 1927)

Variations in Size of Calopteryx Maculata and a Proposed New Subspecies (Odonata, Agrionidae). By John R. Huggins. 355

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